

# **WSDOT MITIGATION SITES**

## **NORTHWEST REGION**

### **2002 MONITORING REPORT**

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## Northwest Region Annual Monitoring Report



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## Executive Summary

The following tables summarize performance criteria and results obtained in 2002.

Site Name	Performance Criteria	2002 Results
<b>SR 2 Monroe Fairgrounds (Year 1 of 5)</b>		
	Wetlands hydrology criteria	Present
	All planted material shall be alive	96% Survival <sup>1</sup>
	≤ 10% noxious weeds on site	< 1% (qualitative)

<b>SR 9 Stillaguamish River (Year 3 of 5)</b>		
	≥ 50% aerial cover of native naturally colonizing plants in the wetland	55% (CI <sub>80%</sub> = 46-64% cover)
	≥ 50% aerial cover of planted and native naturally colonizing plants in the buffer	15% (CI <sub>80%</sub> = 12-19% cover)
	Increase in wildlife use	No statistical increase detected
	≤ 10% aerial cover of invasive species in the wetland	2% (CI <sub>80%</sub> = 1-3% cover)

<b>SR 18 Holder Creek #2 (Year 1 of 5)</b>		
	Replace all dead or inadequately planted species	93% survival (total count)
	<10% non-native invasive cover	1% (CI <sub>80%</sub> = 0-2% cover)
	>10% shrub cover	3% (CI <sub>80%</sub> = 2-4% cover)

<b>SR 18 Pumpkin Patch (Year 5 of 5)</b>		
	35-50% scrub-shrub cover	43% (CI <sub>90%</sub> = 36-50% cover)
	50-80% forested cover	92% (CI <sub>95%</sub> = 83-101% cover)
	50-75% coverage of native species in buffer	72% (CI <sub>95%</sub> = 65-79% cover)
	≥ 90% native species in the wetland	100%
	≥ 90% viability of trees planted	Not Applicable <sup>2</sup>
	An increase in wildlife should be observable	Yes
	Buffer width should range from 10–50 ft	Yes

<b>SR 18 Issaquah-Hobart (Year 5 of 5)</b>		
	≥ 80% woody cover in the wetland	39% (CI <sub>80%</sub> = 31-47% cover)
	≥ 75% woody cover in the buffer (restoration)	15% (CI <sub>80%</sub> = 12-18% cover)
	Difference in height between trees and shrubs	Yes
	≤ 10% invasive cover in the wetland	29% (CI <sub>80%</sub> = 23-35% cover)
	≤ 10% invasive cover in the buffer (restoration)	17% (CI <sub>80%</sub> = 14-20% cover)

<sup>1</sup> Replanting is planned for the spring of 2003.

<sup>2</sup> Plant mortality and natural recruitment often confound results if viability is monitored long after initial plant establishment. For this reason viability was not measured in this site's fifth year of monitoring.

Site Name	Performance Criteria	2002 Results
<b>SR 18 Kendal (Year 5 of 8)</b>		
	≥ 80% cover of woody wetland vegetation in the wetland	30% (CI <sub>90%</sub> = 25-37% cover) <sup>3</sup>
	≥ 75% cover of woody vegetation in the buffer	32% (CI <sub>80%</sub> = 26-38% cover)
	≥ 80% cover of woody plants on the site	36% (CI <sub>90%</sub> = 31-41% cover)
	Height difference between shrubs and trees	Significant difference ( $P < 0.01$ )
	< 10% cover of invasive species	25% (CI <sub>80%</sub> = 20-30% cover)

<b>SR 99 First Ave. South (Year 5 of 5)</b>		
	≥ 75% cover by FAC or wetter native emergent vegetation	85% (CI <sub>90%</sub> = 79-91% cover)
	≥ 75% cover by woody species in the upland forested/shrub buffer	36% (CI <sub>80%</sub> = 29-43% cover)
	Buffer width will average between 30-50 ft	Yes
	Difference in height between trees, shrubs and emergents	Yes
	The wetland system will be tidally inundated twice a day	Yes
	> 10% aerial cover of invasive exotic species	14% (CI <sub>80%</sub> = 10-18% cover)

<b>SR 167 Mill Creek St. 1A (Year 3 of 5)</b>		
	> 15% woody cover in the scrub-shrub zone	32% (CI <sub>90%</sub> = 27-37% cover)
	> 50% FACW or OBL cover in emergent	94% (CI <sub>99%</sub> = 89-99% cover)
	Habitat structures present	Yes

<b>SR 202 Dry Creek (Year 3 of 5)</b>		
	> 60% survival of planted woody species, no fewer than 75% of the total number of species remaining	75% total count
	<15% aerial cover of reed canarygrass in the planted zones	~1% qualitative

<b>SR 203 Harris Creek (Year 3 of 5)</b>		
	≥ 60% survival of planted trees and shrubs with ≥ 75% planted species remaining	<ul style="list-style-type: none"> <li>• Woody: 92% (CI<sub>95%</sub> = 89-96% survival)</li> <li>• Herbaceous: adequate (qualitative)</li> <li>• 94% planted species remaining (17 of 18 spp.)</li> </ul>
	< 15% aerial cover of reed canarygrass	19% (CI <sub>80%</sub> = 16-23% cover)
	≥ 80% survival of planted vegetation	<ul style="list-style-type: none"> <li>• Woody: 92% (CI<sub>95%</sub> = 89-96% survival)</li> <li>• Herbaceous: adequate (qualitative)</li> </ul>
	Functional assessment to determine if goals are met	Increasing capacity to provide the intended wetland functions

<sup>3</sup> Results reflect data collected prior to an accidental maintenance activity that decreased woody vegetation on approximately 1 acre of the site. Although replacement plantings are planned, woody cover percentages presented are higher than current site conditions.

Site Name	Performance Criteria	2002 Results
<b>SR 203 Morris Creek (Year 3 of 5)</b>		
	≥ 60% survival of plantings, with ≥ 75% of planted species remaining	<ul style="list-style-type: none"> <li>• Woody: 95% (CI<sub>90%</sub> = 90-100% survival)</li> <li>• Herbaceous: adequate (qualitative)</li> <li>• 94% planted species remaining (16 of 17 spp.)</li> </ul>
	< 15% cover of reed canarygrass	18% (CI <sub>80%</sub> = 15-21% cover)
	≥ 80% survival of planted species	<ul style="list-style-type: none"> <li>• Woody: 95% (CI<sub>90%</sub> = 90-100% survival)</li> <li>• Herbaceous: adequate (qualitative)</li> </ul>
	Functional assessment to determine if goals are met	Increasing capacity to provide the intended wetland functions

<b>SR 203 Stillwater Hill (Year 1 of 5)</b>		
	≥ 80% survival of planted woody species	97% (total count)
	All dead or unhealthy plants will be replaced	Yes

<b>SR 516 Bartol (Year 5 of 5)</b>		
	≥ 80% cover of woody wetland vegetation in the wetland	Wetland B: 31% (CI <sub>80%</sub> = 22-39% cover) Wetland C: 52% (CI <sub>80%</sub> = 43-61% cover)
	≥ 75% cover of woody vegetation in the buffer area	Buffer A: 13% (CI <sub>80%</sub> = 8%-18% cover)
	≥ 80% cover of woody plants on the site	Buffer A: 13% (CI <sub>80%</sub> = 8-18% cover) Wetland B: 39% (CI <sub>80%</sub> = 31-46% cover) Wetland C: 51% (CI <sub>80%</sub> = 41-61% cover)
	Height difference between shrubs and trees	Significant difference ( $P < 0.01$ )
	< 10% cover of invasive species	Buffer A: 25% (CI <sub>80%</sub> = 21%-29% cover) Wetland B: 9% (CI <sub>80%</sub> = 6%-12% cover) Wetland C: 54% (CI <sub>80%</sub> = 44%-64% cover)

## List of Acronyms

Acronym	Meaning
CI	Confidence Interval (see Methods and Glossary)
ECY	Washington State Dept. of Ecology
FAC	Facultative Indicator Status (Reed 1988)
FACW	Facultative Wetland Indicator Status (Reed 1988)
MP	Mile Post
OBL	Obligate Wetland Indicator Status (Reed 1988)
SR	State Route
USACE	U.S. Army Corps of Engineers
WDFW	Washington Department of Fish and Wildlife
WSDOF	Washington Department of Fisheries
WSDOT	Washington State Department of Transportation



# Introduction

## History

Infrastructure improvements including highway construction projects, highway interchanges, and bridges have accompanied economic and population growth in the state of Washington. The Washington State Department of Transportation (WSDOT) routinely evaluates the potential for degradation of critical areas that result from these infrastructure improvements. WSDOT strictly complies with applicable federal, state, and local environmental regulations, including the Clean Water Act and the state “no net loss” policy for wetlands (Executive Order 89-10). Generally, mitigation sites are planned when transportation improvement projects adversely affect critical areas. The WSDOT Wetland Monitoring Program monitors these mitigation sites as a means of evaluating compliance with permit conditions and tracking overall development. Forty-two sites state-wide were monitored in 2002 (Map 1).

## Purpose

The purpose of this document is to report the status of Northwest Region WSDOT mitigation sites with respect to permit compliance and success standards for 2002 (Map 2).<sup>4</sup> We rely on feedback from the users of this report to ensure its contents are clear, concise, and meaningful.

## Process

Monitoring typically begins the first spring after a site is planted and continues for the time period designated by the permit or mitigation plan. The monitoring period generally ranges from three to ten years. In special cases sites may be monitored beyond the designated monitoring period.

Monitoring activities are driven by site-specific success standards detailed in the mitigation plan or permits. Data are collected on a variety of environmental parameters including vegetation, hydrology, and wildlife. When data analysis is complete, information on site development is communicated to region staff to facilitate management activities as part of an adaptive management process. Monitoring reports are issued to regulatory agencies and published on the web at:

[www.wsdot.wa.gov/environment/eao/wetmon/default.htm](http://www.wsdot.wa.gov/environment/eao/wetmon/default.htm)

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<sup>4</sup> This map shows sites not included in this report. The excluded sites were evaluated for internal feedback only. A report is issued only for sites with success standards that apply to the current year.

## Methods

Methods used for monitoring mitigation sites change as site requirements and customer needs evolve. Quantitative data collection techniques presently in use are based on standard ecological and biostatistical methods.<sup>5</sup> The Monitoring Program's current methods include the following key elements:

### Objective-based Monitoring

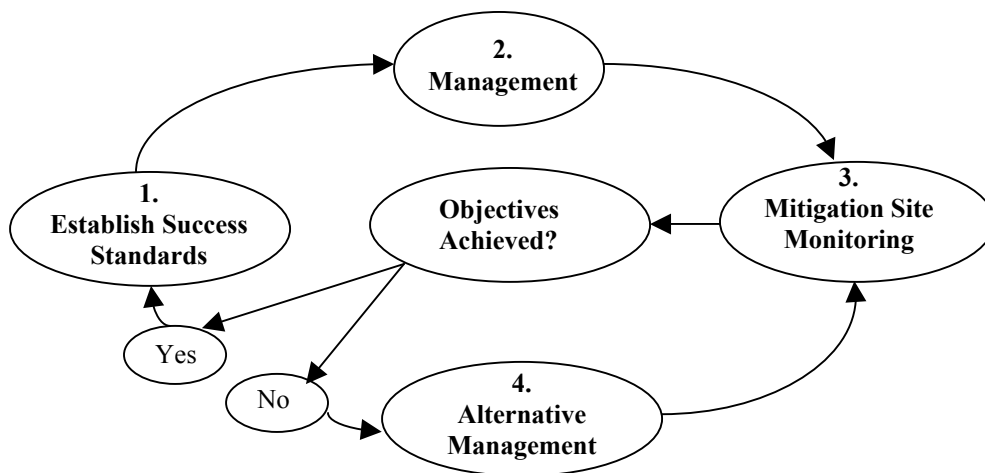
We collect data using a monitoring plan and sampling design developed specifically for each site. The monitoring plan and sampling design address success standards, permit requirements, contingencies, and other considerations as appropriate.

### Adaptive Management

The adaptive management process includes four iterative steps:

1. success standards are developed to describe the desired condition,
2. management action is carried out to meet the success standard,
3. the response of the resource is monitored to determine if the success standard has been met, and
4. management is adapted if the standards are not achieved.

Monitoring is integral to the success of an effective adaptive management strategy. Without valid monitoring data, management actions may or may not result in improved conditions or compliance with regulatory permits. Timely decisions, based on valid monitoring data, result in increased efficiency and higher probabilities of success (Shabman 1995; Thom and Wellman 1996). The adaptive management process is illustrated in Figure 1.1.



(Redrawn from Elzinga et al. 1998).

**Figure 1.1 The Adaptive Management Process**

<sup>5</sup> These methods are based on techniques described in Bonham (1989), Elzinga (1998), Krebs (1999), Zar (1999), and other sources.

### Statistical Rigor

The monitoring program strives to minimize subjectivity in data collection and increase the reliability of data collection and analysis. Important considerations include appropriate sampling design, sampling resolution, random sampling procedures, and sample size analysis. Our goal is to provide customers with an objective evaluation of site conditions based on valid and reliable monitoring data.

### Success Standards and Sampling Objectives

Site objectives and success standards are important elements of a mitigation plan. They indicate the desired state or condition of the mitigation site at a given point in time. Conditional permit requirements, if different from success standards in the mitigation plan, are also evaluated during monitoring activities. Some mitigation plans also provide contingencies if a specific undesirable condition occurs. Contingencies typically initiate a management response at the onset of a particular condition, for example, excessive cover by invasive species or insufficient cover by trees and shrubs.

Monitoring program staff thoroughly examine goals, objectives, success standards, and site permits to understand the desired site condition or characteristics to be measured. Six elements are sought in relation to each success standard to ensure measurability of the desired condition: species indicator, location, attribute, action, quantity/status, and time frame. Where one or more of the six elements is undocumented or unclear in the mitigation plan or permit, clarification is sought from region staff.

Success standards are copied verbatim from the mitigation plan in the Success Standards and Sampling Objectives section of each site report. Several authors use the term “areal” differently than it has been used in many older mitigation plans.<sup>6</sup> We feel that the term “aerial” better describes the intent of the mitigation plans.<sup>7</sup> When “areal” is part of a success standard, we follow it with a (*sic*) notation. The glossary defines the meaning of these words as used in this document.

Information presented in the first table of each site report is obtained directly from the mitigation plan and permits, as appropriate.

Sampling may be required to address success standards unless an efficient and reliable total accounting of the target attribute can be conducted. Sampling objectives are developed to guide the data collection process. Sampling objectives typically include a confidence level and confidence interval half width.

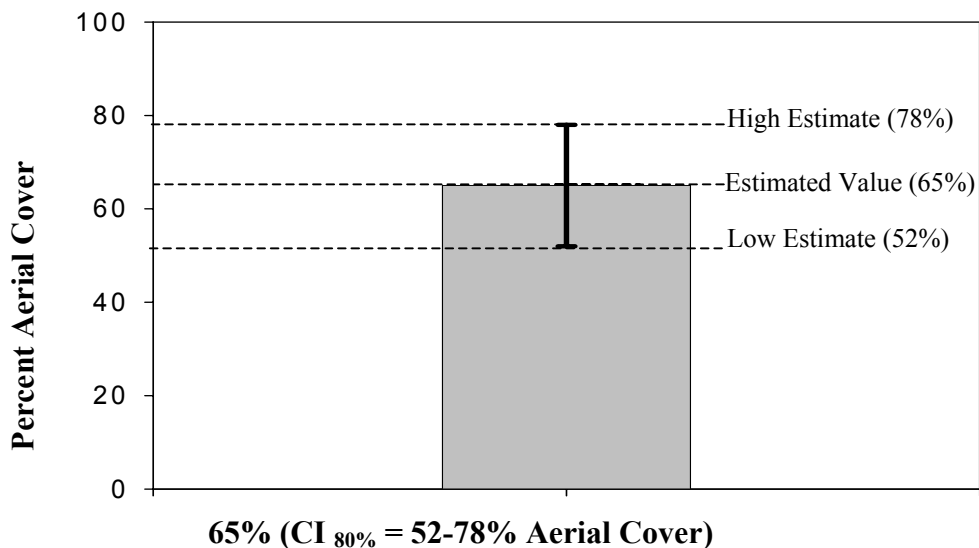
The results of sampling are included in the individual site reports with the confidence level and confidence interval noted as  $(CI_X = Y_1 - Y_2)$ , where  $CI$  = confidence interval,  $X$  = confidence level, and confidence interval width is expressed as  $Y_1$  low estimate to  $Y_2$  high estimate. For example, an estimated aerial cover provided by woody species

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<sup>6</sup> This distinction is based on definitions and usage in Bonham (1989), Hruby et al. (1999), and Williams (2001).

<sup>7</sup> Elzinga et al. (1998), Brower (1998), and Kent and Coker (1995).

reported as 65% ( $CI_{80\%} = 52\text{-}78\%$  aerial cover) means that we are 80% confident that the true aerial cover value is between 52% and 78% (Figure 1.2).



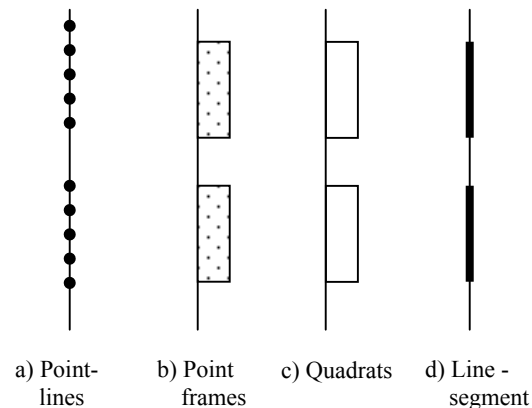
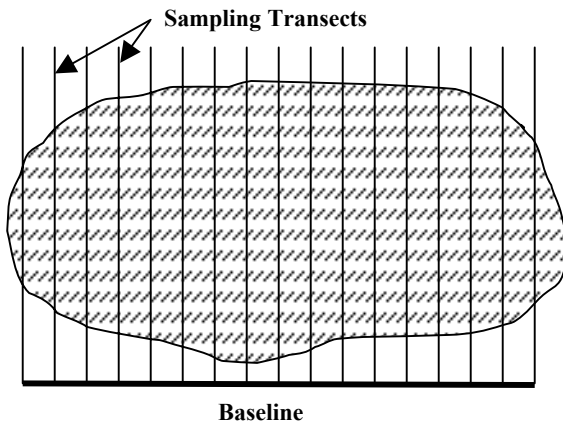
**Figure 1.2 Estimated Cover Value Expressed with Confidence Interval Range**

For compliance purposes, aerial cover calculations include only areas covered by rooted vascular plants (including floating-leaved species). Areas covered by thallophytes (algae, fungi, bacteria), bryophytes (mosses and liverworts), structures, or aquatic vegetation are not included in aerial cover calculations. Scientific names, most common names, and nativity used in this report were obtained from the *PLANTS Database* (USDA 2002). Hydrophytic plant indicator status was obtained from the *National List of Plant Species that Occur in Wetlands: Northwest* (Reed 1988 and 1993). Where invasive or noxious weeds are addressed, county specific listings in the *State Noxious Weed List* are referenced (Washington State Noxious Weed Control Board 2002).<sup>8</sup>

### Sampling Design

When sampling is required, a sampling design is developed for the site or zone of interest. Sampling designs can vary from simple to complex depending on the number and type of attributes to be measured. Specific elements such as the size and shape of the site, the presence of environmental gradients, plant distribution patterns, and the amount of time and resources available for monitoring are factors that influence the sampling design. Elements of the sampling design may include the location of the baseline, orientation of transects (Figure 1.3), the method of data collection, and the number and type of sample units to be used. Depending on the sampling objective and site characteristics, transects may vary in number, length, and separation distance. Sampling transect locations are determined by using either a simple, systematic, stratified, or restricted random sampling method.

<sup>8</sup> In some cases, other nuisance species may be included in invasive cover estimates.



**Figure 1.3 Baseline and Sampling Transects**

**Figure 1.4 (a-d) Sampling Transects and Sample Units**

A diagram showing the sampling design is typically included in mitigation site reports. Sample units appropriate to one or more of the methods described below are randomly located on or adjacent to the sampling transects (Figure 1.4 a-d). These drawings are general representations of the actual sampling designs and do not include specific details.

#### The Point-Line Method

The point-line technique (Bonham 1989; Elzinga et al. 1998) can be used where vegetative cover is an attribute of interest. This method involves randomly locating sample units consisting of fixed sets of points along sampling transects (Figure 1.4a). Tools used to collect point-line data include point-intercept devices, pin flags, or densitometers. These tools are used to identify point locations. Target vegetation intercepted by the point locator is recorded. If target species are not encountered on the point; bare soil, non-vascular plant, or habitat structure is recorded as appropriate. For each sample unit, cover is determined based on the number of times target vegetation is encountered divided by the total number of points. For example, if invasive species were encountered on 20 points from a sample unit composed of 100 points, the aerial cover of invasive species for that sample unit is 20%.

#### The Point-Frame Method

Point-frames are another tool that may be used to measure vegetative cover (Bonham 1989; Elzinga et al. 1998). A point frame is a rectangular frame that encloses a set of points collectively serving as a sample unit (Figure 1.4b).<sup>9</sup> The sample unit is lowered over herbaceous vegetation and data is recorded where target vegetation intercepts point locations. As with the point-line method, a cover value for each sample unit is determined. For example, if FACW and OBL species were encountered on 20 points in a point-frame composed of 40 points, the aerial cover of FACW and OBL species for that point-frame sample unit is 50%.

<sup>9</sup> The WSDOT Monitoring Program typically uses a frame formed with polyvinyl chloride (PVC). Strings span the frame lengthwise and points are marked on the strings using a standard randomization method.

### Quadrat Method

To measure survival or density of planted trees and shrubs in an area, quadrat sample units are randomly located along sampling transects (Bonham 1989; Elzinga et al. 1998). Quadrat width and length are based on characteristics of the vegetative community and patterns of plant distribution. Quadrats are typically located lengthwise along sampling transects (Figure 1.4c). Plants within a quadrat are recorded as alive, stressed or dead. The success standard or contingency threshold can be addressed with a mean percent survival estimate of plantings, or a density per square meter of living plantings as appropriate. For example, if 8 planted woody species were recorded as alive and 2 were recorded as dead in a sample unit measuring 1 x 20 m, the survival of planted woody species for that sample unit would be 80%, and the density would be 0.4 live plants per square meter.

### Line-Intercept Method

Cover data for the woody species community is collected using the line-intercept method (Bonham 1989; Elzinga et al. 1998).<sup>10</sup> Line-segments, serving as sample units, are randomly located along sampling transects (Figure 1.4d). All woody vegetation intercepting the length of each sample unit is identified and the length of each canopy intercept recorded. For each sample unit, the sum of the canopy intercept lengths is divided by the total length to calculate an aerial cover value. For example, if woody vegetation was encountered on 80 meters from a 100 meter sample unit, the aerial cover for that sample unit is 80%.

### Sample Size Analysis

With each of the above methods, sample size analysis is performed in the field to ensure that an adequate number of sample units are obtained to report the data at the specified confidence level and interval. The mean percent aerial cover value and standard deviation are calculated from the data, and sample size analysis is conducted. For data reported in this document, the following sample size equation for estimating a single population mean or a population total within a specified level of precision was used to perform this analysis (Elzinga et al. 1998).

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>11</sup>  
 $n$  = unadjusted sample size

A sample size correction to  $n$  is necessary for adjusting “point-in-time” parameter estimates.<sup>12</sup> It is the adjusted  $n$  value that reveals the number of sample units required to report the estimated mean value at a specified level of confidence.

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<sup>10</sup> Depending on site conditions and other considerations, woody cover data may be collected using the point-line method and a densitometer.

<sup>11</sup> In this equation, the precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

<sup>12</sup> Adjusted  $n$  values found in this report were obtained using the algorithm for a one-sample tolerance probability of 0.90 (Kupper and Hafner 1989; Elzinga et al 1998).

## **Wildlife Monitoring**

Many mitigation plans include goals and objectives that address wildlife. For these sites, wildlife monitoring is conducted to provide information to support the results of the vegetation monitoring. An example of an objective that triggers such wildlife monitoring is presented below:

### Objective - Wildlife

Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of fruit bearing shrubs and stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. Overall, creating an emergent and scrub-shrub wetland is intended to provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians.

Some success standards contain more specific reference to monitoring wildlife. In these cases, a variety of wildlife monitoring techniques (see sections below) are used to evaluate success. An example of such a success standard follows:

### Success Standard:

Development of habitat diversity and structure will be determined by the diversity and numbers of wetland dependent species identified during the monitoring period. The sites will meet this objective if wildlife species that utilize wetlands for some or all of their habitat requirements are located.

Incidental wildlife observations are recorded during all site visits.

### Bird Monitoring

Sites with goals, objectives or success standards addressing the avian community receive three to four bird surveys conducted during the breeding season (April through mid-July). The point count method (Ralph et al. 1993) is used to document species richness and relative abundance.

Species diversity indices (H) may be calculated from bird survey data using the Shannon-Wiener function (Krebs 1999). Results are expressed as a mean annual species diversity index.

$$H' = -\sum_{i=1}^s (p_i)(\log p_i)$$

$H'$  = index of species diversity  
 $s$  = number of species  
 $p_i$  = proportion of sample belonging to  $i$ th species

The following  $t$  test is used to test the null hypothesis that diversity indices from different years are equal (Zar 1999).

$$t = \frac{H'_1 - H'_2}{S_{H'_1 - H'_2}}$$

$H'$  = index of species diversity

$S_{H'_1 - H'_2}$  = standard error of the difference between species diversity indices  $H'_1$  and  $H'_2$

### Amphibian Monitoring

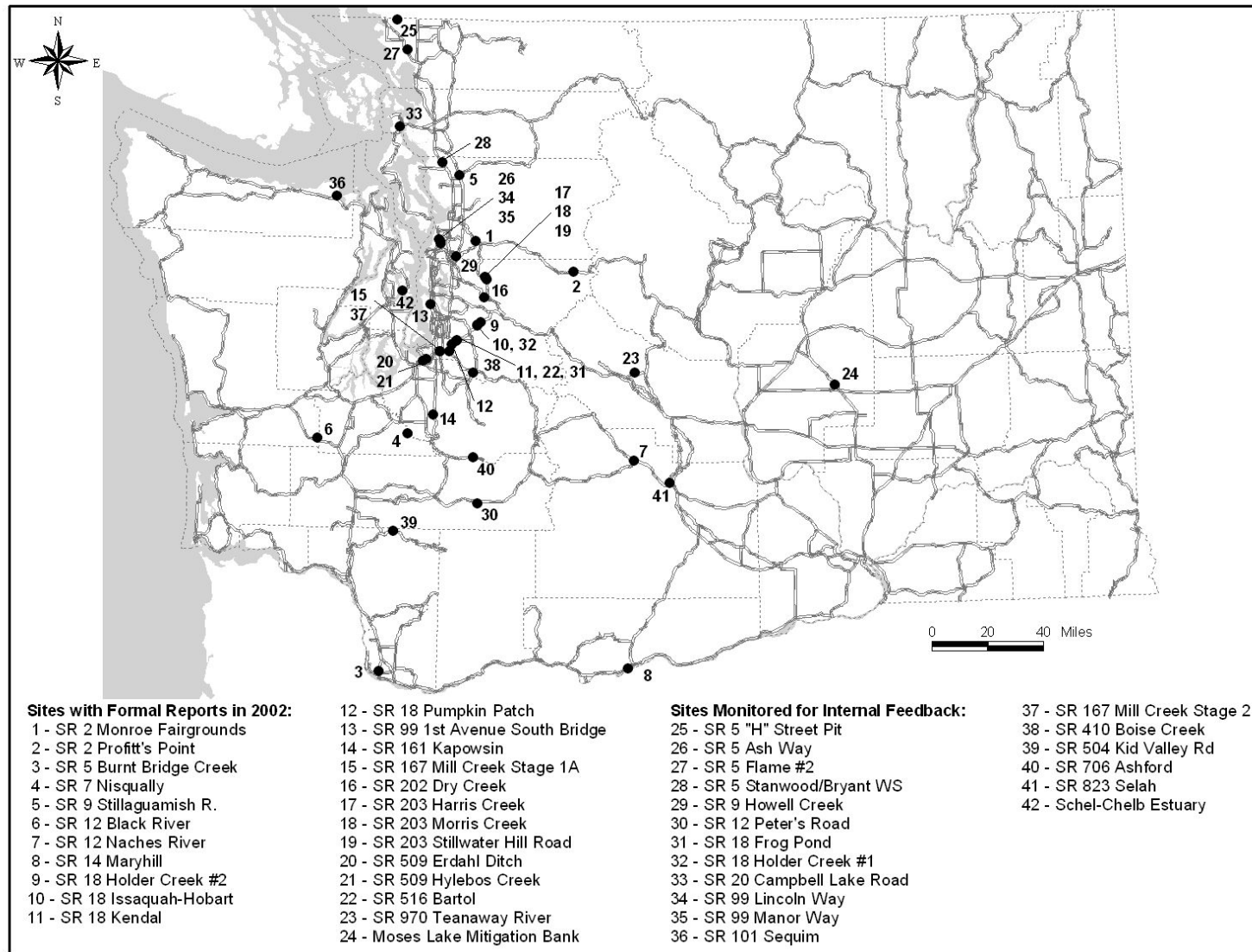
Sites with goals, objectives, or standards referencing amphibians may be monitored using methods adapted from Olson et al. (1997). Methods may include funnel trapping on sites with a water depth of 1 dm or greater. Call surveys and area searches may be used to assess terrestrial components of sites without standing water. Incidental amphibian observations are recorded during other monitoring activities. Potential for amphibian habitat may be qualitatively assessed.

### **Hydrology Monitoring**

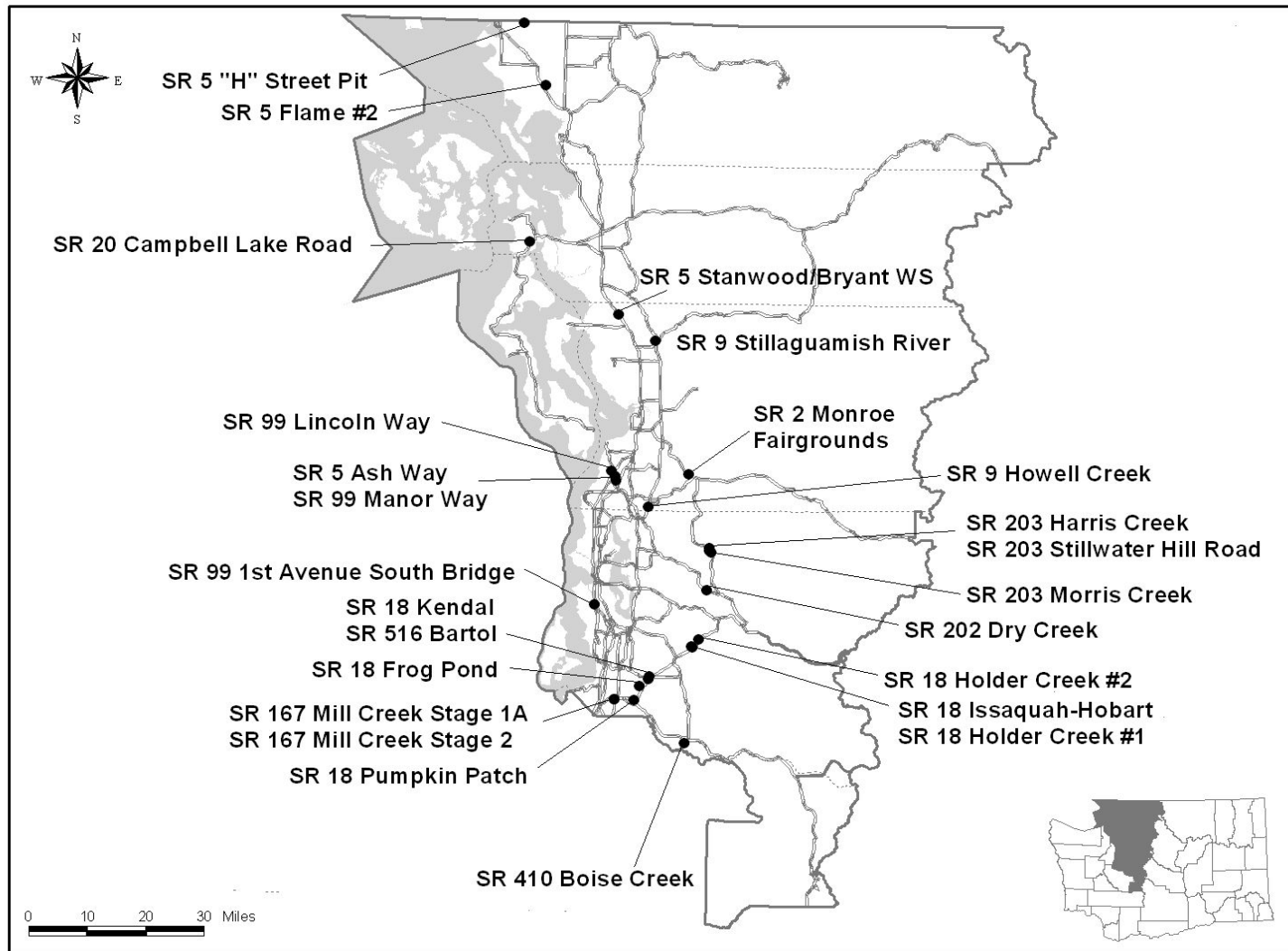
Field indicators of wetland hydrology (Washington State Department of Ecology 1997) are recorded to address hydrology standards and to aid in future delineation efforts. Wetland mitigation sites are delineated after the last year of vegetation monitoring so that actual acreages can be compared to the planned wetland area.



# Map 1: WSDOT Mitigation Sites Monitored in 2002



**Map 2: Northwest Region Sites Monitored in 2002**



## Snohomish County Sites

### SR 2 Monroe Fairgrounds, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 2 Monroe Fairgrounds mitigation site in July 2002. Monitoring data were obtained to address first year success standards. Activities included a total count of tree and shrub plantings and a qualitative assessment of overall site development. Table 2.1 shows general site information and Table 2.2 provides this year's monitoring results.

**Table 2.1 General Site Information for the SR 2 Monroe Fairgrounds Mitigation Site**

<b>Project Name</b>	SR 2: SR 9 Interchange to SR 522
<b>USACE Permit Number</b>	1999-4-00390
<b>Mitigation Location</b>	North side of SR 2, West of Monroe Fairgrounds, Snohomish Co.
<b>Township/Range/Section (Impact)</b>	T.28N/R.06E/S.35, NE ¼ SE¼
<b>Monitoring Period</b>	2002 - 2006
<b>Year of Monitoring</b>	1 of 5
<b>Area of Project Impact</b>	0.006 ha (0.014 ac)
<b>Type of Mitigation</b>	Wetland Restoration, Wetland/Stream Buffer Creation
<b>Area of Mitigation</b>	0.060 ha (0.150 ac)

**Table 2.2 Monitoring Summary for the SR 2 Monroe Fairgrounds Mitigation Site**

<b>Performance Criteria</b>	<b>2002 Results</b>
1. Wetlands hydrology criteria	Present
2. All planted material shall be alive	96% Survival <sup>13</sup>
3. ≤ 10% noxious weeds on site	< 1% (qualitative)

### Success Standards and Sampling Objectives

First year success standards for the SR 2 Monroe Fairgrounds mitigation site were excerpted from the *Final Wetland and Buffer Mitigation Plan SR 2: SR 9 Interchange to SR 522* (MP 4.36 to 14.27) (Antieau and Kruger 2000). Appendix A provides the complete text of the success standards for this project.

<sup>13</sup> Replanting is planned for the spring of 2003.

### Success Standard 1

In a year of normal precipitation, at least 0.014 ac of the mitigation site supports a hydroperiod that meets the hydrology criterion for wetlands (Environmental Laboratory 1987).

### Success Standard 2

At the end of the first growing season all planted material shall be alive (100% survival).

### Success Standard 3

Class A noxious weeds listed in Snohomish County will comprise no more than 10% of the relative (adjusted to 100%) areal (*sic*) cover of the entire wetland and buffer site.

## **Methods**

Success Standard 1 was addressed with qualitative hydrology observations made during site visits on April 17 and July 17, 2002.

To address Success Standard 2 regarding survival, a total count of woody plantings was conducted in July 2002. Individual trees and shrubs were recorded as alive or dead. The total percent survival was determined by dividing the number of living of plantings by the total number of plantings observed.

The noxious weed requirement in Success Standard 3 was addressed with a qualitative assessment. Quantitative sampling was not considered appropriate due to the near absence of undesirable species.

## **Results and Discussion**

The SR 2 Monroe Fairgrounds mitigation site is developing well in its first year (Figure 2.1). Replacement is planned for the few dead plantings encountered during monitoring visits and the intended hydrology is present. A brief discussion of each success standard follows.

### Success Standard 1 – Wetlands Hydrology Criteria

Site visits were made on April 17 and July 17, 2002 to evaluate the hydrological requirement in Success Standard 1. At the time of the April visit, all of the wetland



**Figure 2.1** SR 2 Monroe Fairgrounds Mitigation Site (April 2002)

mitigation area was inundated or saturated to the surface (Figure 2.1). In July, an estimated 75% of the wetland area was saturated to the surface. These observations suggest that in years of normal precipitation the mitigation site supports a hydroperiod that meets the hydrology criterion for wetlands (Environmental Laboratory 1987).

#### Success Standard 2 – All Planted Material Shall Be Alive

The total survival of planted material on site is 96%. Twelve dead plantings were counted. Replacement of dead plant material is planned for the spring of 2003. Table 2.3 shows the results of the total count of planted trees and shrubs on site.

**Table 2.3 Survival of Trees and Shrubs at SR 2 Monroe Fairgrounds Mitigation Site**

<b>Scientific Name (Common Name)</b>	<b>Alive</b>	<b>Dead</b>	<b>Total</b>
<i>Corylus cornuta</i> (beaked hazelnut)	29	3	32
<i>Cornus sericea</i> (redosier dogwood)	26	0	26
<i>Fraxinus latifolia</i> (Oregon ash)	10	0	10
<i>Picea sitchensis</i> (Sitka spruce)	10	0	10
<i>Rosa</i> sp. (roses)	31	9	40
<i>Rubus spectabilis</i> (salmonberry)	45	0	45
<i>Salix</i> sp. (willows)	21	0	21
<i>Sambucus racemosa</i> (red elderberry)	34	0	34
<i>Symphoricarpos albus</i> (common snowberry)	79	0	79
<b>Total</b>	<b>285</b>	<b>12</b>	<b>297</b>

#### Success Standard 3 – Less Than 10% Noxious Weeds

Class A noxious weeds listed in Snohomish County (Snohomish County Noxious Weed Control Board 2001) are to comprise no more than 10% relative cover on the site. Class A noxious weeds were not identified on site, and trace levels of undesirable species were removed from the site.

*Phalaris arundinacea* (reed canarygrass) is expected to be a component of this mitigation site due to its prevalence in the surrounding landscape. Thus, no performance standards are directed specifically at *P. arundinacea* (Anteau and Kruger 2000). It is qualitatively estimated to contribute 20 to 30% aerial cover on site.

## SR 9 Stillaguamish River, Snohomish County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 9 Stillaguamish River mitigation site in July 2002. Monitoring data were obtained to compare to third year success standards. Activities include surveys of the buffer and wetland plant communities. Table 3.1 provides general site information and Table 3.2 summarizes this year's monitoring results.

**Table 3.1 General Site Information for the SR 9 Stillaguamish River Mitigation Site**

<b>Project Name</b>	SR 9 Stillaguamish/Haller Bridge 9/132	
<b>Contract Number</b>	CN MS4439	
<b>USACE IP Permit Number</b>	97-4-0069	
<b>ECY Permit Number</b>	SO3-003-86	
<b>Mitigation Location</b>	SR 9 Bridge over Stillaguamish River, Snohomish County	
<b>Township/Range/Section (impact)</b>	T.31N/R.5E/S.2	
<b>Monitoring Period</b>	2000 to 2004	
<b>Year of Monitoring</b>	3 of 5	
<b>Area of Project Impact</b>	0.36 ha (0.89 ac)	
<b>Type of Mitigation</b>	Wetland creation	Wetland Buffer
<b>Area of Mitigation</b>	0.96 ha (2.73 ac)	0.69 ha (1.71 ac)

**Table 3.2 Monitoring Summary SR 9 Stillaguamish River Mitigation Site**

Performance Criteria	2002 Results <sup>14</sup>
<b>Success Standard</b>	
1. $\geq 50\%$ aerial cover of native naturally colonizing plants in the wetland	55% ( $CI_{80\%} = 46\text{-}64\%$ cover)
2. $\geq 50\%$ aerial cover of planted and native naturally colonizing plants in the buffer	15% ( $CI_{80\%} = 12\text{-}19\%$ cover)
3. Increase in wildlife use	No statistical increase detected
<b>Contingency Plan</b>	
4. $\leq 10\%$ aerial cover of invasive species in the wetland	2% ( $CI_{80\%} = 1\text{-}3\%$ cover)

### Success Standards and Sampling Objectives

Third year success standards for the SR 9 Stillaguamish River mitigation site were excerpted from the *SR 9 Stillaguamish/Haller Bridge 9/132 Replacement Wetland Mitigation Plan* (WSDOT 1997). A companion sampling objective follows the success standards where appropriate. Appendix B provides the complete text of the success standards and additional permit requirements for this project.

<sup>14</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 55% ( $CI_{80\%} = 46\text{-}64\%$  aerial cover) means we are 80% confident that the true aerial cover value is between 46% and 64%.

### Success Standard 1

After three years the wetland will be comprised of 75% or greater native facultative or wetter species or will be comprised of a planted and native, naturally colonizing plant community at 50% or greater areal (*sic*) cover (2002).

#### Sampling Objective 1

To be 80% confident the true aerial cover by native species in the wetland is within 20% of the estimated value.

### Success Standard 2

After three years the buffer will have 75% cover of native species or will be comprised of a planted and native naturally colonizing plant community at 50% or greater areal (*sic*) cover (2002).

#### Sampling Objective 2

To be 80% confident the true aerial cover by native species in the buffer is within 20% of the estimated value.

### Success Standard 3

After three years increases in wildlife cover and forage species should improve habitat structure which should result in a corresponding increase in wildlife use (2002).

### Contingency Plan

A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2002).

#### Sampling Objective

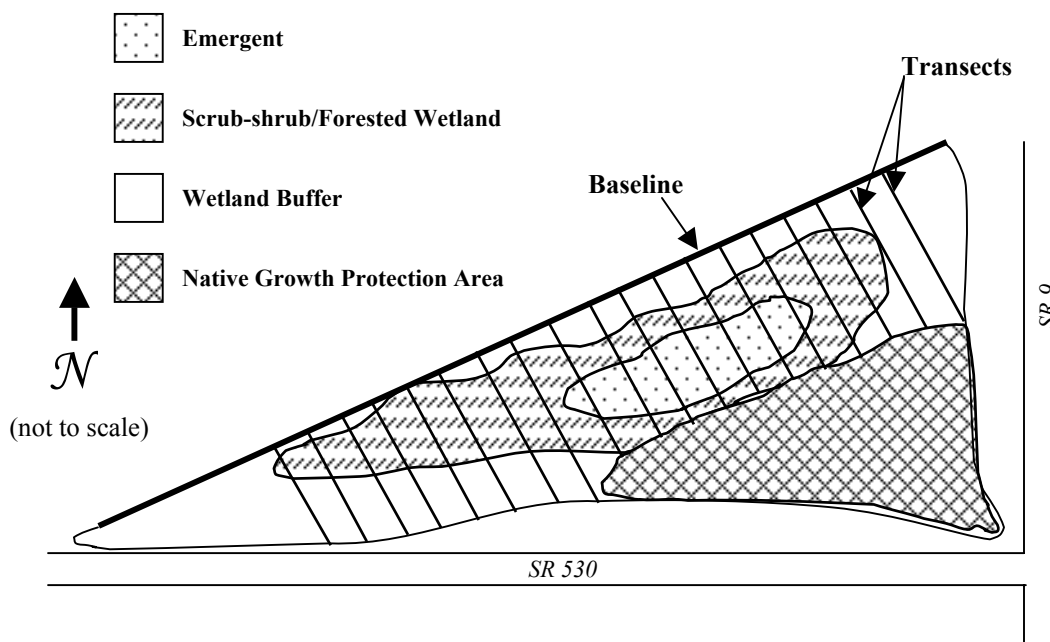
To be 80% confident the true cover by invasive exotic species is within 20% of the estimated value.

### ECY Permit Requirement

A monitoring report shall be prepared at Year 3 of the project showing the elements listed in the "As-Built" report issued June 14, 2000.

## **Methods**

To evaluate aerial cover of both woody and herbaceous species, 30 temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 3.1).



**Figure 3.1 SR 9 Stillaguamish River Mitigation Site Sampling Design (2002)**

Thirty-one 20-m point-line sample units (40 points each) were randomly positioned along sampling transects to address aerial cover provided by the native naturally colonizing plant community in the wetland zone (Success Standard 1).

To address aerial cover of the planted and native naturally colonizing plant community in the buffer (Success Standard 2), data were collected from 64 10-m point-line sample units (20 points each) randomly located along sampling transects.

Aerial cover of invasive exotic species in the wetland (Contingency Plan) was addressed with 31 20-m point-line sample units (40 points each). The sample units were randomly located along sampling transects across the entire site.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>15</sup>  
 $n$  = unadjusted sample size

Four bird surveys were conducted between mid-May and early July to provide supporting information on wildlife use (Success Standard 3). Species richness and relative abundance were recorded. Species diversity indices ( $H$ ) were calculated for each bird survey using the Shannon-Wiener function (Krebs 1999).

<sup>15</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.



$$H' = -\sum_{i=1}^s (p_i)(\log p_i)$$

$H'$  = index of species diversity

$s$  = number of species

$p_i$  = proportion of sample belonging to  $i$ th species

Incidental wildlife observations were also recorded.

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1 – At Least 50% Aerial Cover by Native Naturally Colonizing Plants in the Wetland

The aerial cover of the native herbaceous and woody naturally colonizing plant community in the wetland is estimated to be 55% ( $CI_{80\%} = 46\text{-}64\%$  cover). This meets the third year cover requirement. *Populus balsamifera* (balsam poplar) and *Salix sitchensis* (Sitka willow) contribute the majority of this cover (Figure 3.2).



Figure 3.2 SR 9 Stillaguamish River (July 2002)

### Success Standard 2 – At Least 50% Aerial Cover by Planted and Native Naturally Colonizing Plants in the Buffer

Aerial cover provided by herbaceous and woody planted and native naturally colonizing buffer plant community was estimated to be 15% ( $CI_{80\%} = 12\text{-}19\%$  cover). This does not meet the third year 50% requirement (Figure 3.2). Non-native grasses including *Alopecurus pratensis* (meadow foxtail), *Holcus lanatus* (common velvetgrass), and *Dactylis glomerata* (orchard grass) dominate the buffer plant community. The contingency states that if the site does not have a minimum of 50% native aerial coverage after the third growing season additional planting will be performed.

### Success Standard 3 – Increase in Wildlife Cover and Use

Success Standard 3 states that after three years, increases in wildlife cover and forage species should improve habitat structure, which should result in a corresponding increase in wildlife use. Bird surveys were conducted to provide supporting wildlife information.

A statistically significant increase was not shown in bird species diversity from year 2000 to 2002 (Table 3.3). However, throughout the monitoring period (2000 to present), a total of 33 species have been observed on the site. Seven of the 33 bird species are wetland-dependent and two are wetland-associated (Table 3.4). Small mammals, garter snakes (*Thamnophis* sp.) and deer (*Odocoileus hemionus*) have also been observed on-site.

**Table 3.3 SR 9 Stillaguamish River Mitigation Site Bird Survey Results**

Attribute	Year 2000	Year 2001	Year 2002
Mean Species Richness	18 species	19 species	19 species
Mean Family Richness	14 avian families	11 avian families	12 avian families
Species Diversity Index			
Mean H'	0.8997	0.9686	1.0246
Standard Error	0.0574	0.0607	0.0604
Range	0.7699 – 1.0432	0.8605 – 1.1423	0.9042 – 1.0917

**Table 3.4 SR 9 Stillaguamish River Mitigation Site Bird Status**

Common Name	Scientific Name	Status <sup>16</sup>
Barn Swallow	<i>Hirundo rustica</i>	Wetland-associated
Canada Goose	<i>Branta canadensis</i>	Wetland-dependent
Common Yellowthroat	<i>Geothlypis trichas</i>	Wetland-dependent
Killdeer	<i>Charadrius vociferus</i>	Wetland-associated
Mallard	<i>Anas platyrhynchos</i>	Wetland-dependent
Marsh Wren	<i>Cistothorus palustris</i>	Wetland-dependent
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Wetland-dependent
Tree Swallow	<i>Tachycineta bicolor</i>	Wetland-dependent
Willow Flycatcher	<i>Empidonax traillii</i>	Wetland-dependent

#### Contingency – Less Than 10% Aerial Cover of Invasive Exotic Species in the Wetland

Aerial cover provided by invasive exotic species in the wetland is estimated to be 2% (CI<sub>80%</sub> = 1-3% cover). This value is below the contingency threshold and does not trigger a weed control program. *Phalaris arundinacea* (reed canarygrass) and *Rubus armeniacus* (Himalayan blackberry) are two invasive exotic species that were observed on the site.

#### Permit – Elements for the “As-Built” Report

Appendix B contains as-built information required by the ECY SO3-003-86 permit.

<sup>16</sup> Birds are assigned an upland or wetland-dependent species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

## King County Sites

### SR 18 Holder Creek #2, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 18 Holder Creek #2 mitigation site in September 2002. Monitoring data were obtained to compare to first year success standards and permit requirements. Activities include vegetation surveys of the wetland and buffer plant communities. Table 4.1 provides general site information and Table 4.2 summarizes this year's monitoring results.

**Table 4.1 General Site Information for the SR 18 Holder Creek #2 Mitigation Site**

<b>Project Name</b>	SR 18 Slope Stabilization Holder Creek Vicinity	
<b>Contract Number</b>	FA MS3962	
<b>USACE NWP 23 Permit</b>	NWP 98-4-02323	
<b>King County Grading and Clearing Permit</b>	LL CG504	
<b>Mitigation Location</b>	SR 18, Bridge over tributary to Holder Creek at MP 22.3, King County	
<b>Township/Range/Section (impact)</b>	T.23N/R.7E/S.30	
<b>Monitoring Period</b>	2002 to 2006	
<b>Year of Monitoring</b>	1 of 5	
<b>Area of Project Impact</b>	Temporary Wetland: 0.008 ha (0.002 ac), Permanent buffer: 0.03 ha (0.08 ac)	
<b>Type of Mitigation</b>	Wetland Restoration	Buffer Restoration
<b>Area of Mitigation</b>	0.008 ha (0.002 ac)	0.14 ha (0.35 ac)

**Table 4.2 Monitoring Summary for the SR 18 Holder Creek #2 Mitigation Site**

<b>Performance Criteria</b>	<b>2002 Results<sup>17</sup></b>
1. Replace all dead or inadequately planted species	93% survival (total count)
2. <10% non-native invasive cover	1% (CI <sub>80%</sub> = 0-2% cover)
3. >10% shrub cover	3% (CI <sub>80%</sub> = 2-4% cover)

### Success Standards and Sampling Objectives

First year success standards for the SR 18 Holder Creek #2 mitigation site were excerpted from the *SR 18 Holder Creek Vicinity Slope Stabilization Sensitive Area Mitigation Plan* (Mesich and Steinmetz 2000). Sampling objectives follow success standards, where appropriate. Appendix D provides the complete text of the success standards and additional permit requirements for this project.

<sup>17</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 1% (CI<sub>80%</sub> = 0-2% aerial cover) means we are 80% confident that the true aerial cover value is between 0% and 2%.

### Success Standard 1

Plant establishment will be assessed in both the buffer and the wetland, and all dead or inadequately planted species will be replaced (2002).

### Success Standard 2

Non-native invasive plants shall not make up more than 10% of cover in any growing season.

### Sampling Objective 2

To be 80% confident the true aerial cover by non-native invasive species is within 20% of the estimated value.

### Permit Requirement

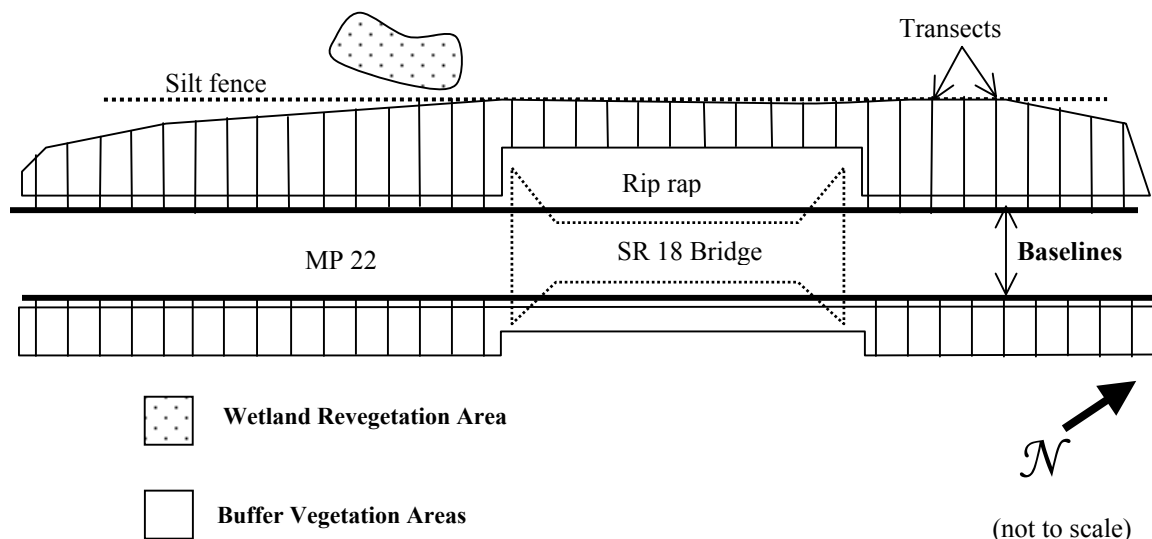
Shrub cover shall be greater than 10% after one year (2002).

### Sampling Objective

To be 80% confident the true aerial cover by shrub species is within 20% of the estimated value

## **Methods**

Baselines were established along the guardrails of SR 18. Fifty-five temporary transects were placed perpendicular to the baselines using a systematic random sampling method (Figure 4.1).



**Figure 4.1 SR 18 Holder Creek #2 Mitigation Site Sampling Design (2002)**

To address plant establishment for Success Standard 1, a total count of woody plantings was conducted. Planted individuals were identified and recorded as alive, stressed, or dead.

To address aerial cover by invasive species for Success Standard 2 and the Permit Requirement, the point-line method was used. Invasive and woody species data were collected at 20 points each on 73 5-m sample units randomly located along sampling transects. Two sample units were also located in the wetland area.

Photographs were taken as specified in the reporting requirements in the permit. A site sketch is included that shows lines of sight for each photograph. This sketch is presented with the photographs in Appendix C.

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>18</sup>  
 $n$  = unadjusted sample size

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1 – Replace All Dead Plantings

Survival of planted species combined for all zones is 93% (Table 4.3). Forty-one plants were dead and should be replaced. Volunteer *Alnus rubra* (red alder) and *Spiraea douglasii* (hardhack) were not counted.

### Success Standard 2 – Less Than 10% Non-Native Invasive Cover

The aerial cover estimate for invasive species is 1% (CI<sub>80%</sub> = 0-2% aerial cover). Invasives were observed mostly near the north corner of the site and along the downhill site boundary. Data were collected on the following species:

- *Sonchus arvensis* (field sowthistle)
- *Geranium robertianum* (stinky Bob)
- *Hypericum perforatum* (common St. Johnswort)
- *Cirsium vulgare* (bull thistle)
- *Rubus laciniatus* (cutleaf blackberry)

### Permit Requirement – At Least 10% Shrub Cover

The aerial cover estimate for planted woody species is 3% (CI<sub>80%</sub> = 2-4% aerial cover) on the site. This community was planted in the spring prior to monitoring, and while the first year success standard was not met, the third year success standard of 30% may be achieved by 2004 (Appendix C).

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<sup>18</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

**Table 4.3 Total Count of Planted Trees and Shrubs at SR 18 Holder Creek #2**

<b>Scientific Name (Common Name)</b>	<b>Alive</b>	<b>Stressed</b>	<b>Dead</b>	<b>Survival</b>
<b>Uphill Buffer</b>				
<i>Rubus spectabilis</i> (salmonberry)	102	91	20	91%
<i>Sambucus racemosa</i> (red elderberry)	39	27	1	99%
<i>Cornus sericea</i> (redosier dogwood)	88	14	0	100%
<i>Salix</i> sp. (willows)	47	7	5	93%
Unknown	0	0	13	0%
<b>Downhill Buffer</b>				
<i>Thuja plicata</i> (western red cedar)	93	0	0	100%
<b>Wetland</b>				
<i>Salix</i> sp. (willows)	38	1	2	95%
<i>Cornus sericea</i> (redosier dogwood)	21	0	0	100%
<i>Acer circinatum</i> (vine maple)	1	0	0	100%
<i>Rubus spectabilis</i> (salmonberry)	3	0	0	100%
<i>Sambucus racemosa</i> (red elderberry)	2	0	0	100%
<b>Total</b>	<b>434</b>	<b>140</b>	<b>41</b>	<b>93%</b>

Additional information required by the King County permit (photographs and calculations) are contained in Appendix C.

## SR 18 Pumpkin Patch, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 18 Pumpkin Patch mitigation site in July 2002. Monitoring data were obtained to address fifth year success standards. Activities included surveys of herbaceous and woody vegetation and wildlife surveys. Table 5.1 shows this year's monitoring results and Table 5.2 provides general site information.

**Table 5.1 General Site Information for the SR 18 Pumpkin Patch Mitigation Site**

<b>Project Name</b>	SR 18 Auburn-Black Diamond Rd. to SE 312 <sup>th</sup> Way
<b>Contract Number</b>	CI MS 3786
<b>USCE Permit Number</b>	93-4-00146
<b>Mitigation Location</b>	I/C Auburn-Black Diamond Rd. and SR 18, King County
<b>Township/Range/Section (impact)</b>	T.22N/R.05E/S.06
<b>Monitoring Period</b>	1998 - 2002
<b>Year of Monitoring</b>	5 of 5
<b>Area of Project Impact</b>	0.13 ha (0.33 ac)
<b>Type of Mitigation</b>	Wetland creation, enhancement
<b>Area of Mitigation</b>	0.24 ha (0.60 ac)

**Table 5.2 Monitoring Summary SR 18 Pumpkin Patch Mitigation Site**

<b>Success Standard</b>	<b>2002 Results<sup>19</sup></b>
1. 35-50% scrub-shrub cover	43% (CI <sub>90%</sub> = 36-50% cover)
2. 50-80% forested cover, and 2 species provide 30% cover each	92% (CI <sub>95%</sub> = 83-101% cover) and 2 species contribute 46% each
3. 50-75% coverage of native species in buffer	72% (CI <sub>95%</sub> = 65-79% cover)
4. ≥ 90% native species in the wetland	100%
5. ≥ 90% viability of trees planted	Not Applicable <sup>20</sup>
6. An increase in wildlife should be observable	Yes
7. Buffer width should range from 10–50 feet	Yes

### Success Standards and Sampling Objectives

Fifth year success standards for the SR 18 Pumpkin Patch mitigation site are summarized from the *Wetland Mitigation Plan SR 18 Auburn-Black Diamond Road to*

<sup>19</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 43% (CI<sub>90%</sub> = 36-50% cover) means we are 90% confident that the true aerial cover value is between 36% and 50%.

<sup>20</sup> Plant mortality and natural recruitment often confound results if viability is monitored long after initial plant establishment. For this reason viability was not measured in this site's fifth year of monitoring.

*SE 312<sup>th</sup> Way* (WSDOT 1993). Sampling objectives follow the success standard where appropriate. Appendix D provides the complete text of the success standards for this project.

#### Success Standard 1

The wetland should have about 35-50% scrub-shrub coverage with at least 2 species providing 30% of this cover each (2002).

##### Sampling Objective 1

To be 80% confident the true aerial cover of scrub-shrub species in the wetland are within 20% of estimated values.

#### Success Standard 2

About 50-80% forested coverage with at least 2 species providing 40% of the areal (*sic*) coverage each (2002).

##### Sampling Objective 2

To be 80% confident the true cover of trees in the wetland are within 20% of estimated values.

#### Success Standard 3

The buffer has 50-75% areal (*sic*) coverage of native species (2002).

##### Sampling Objective 3

To be 80% confident the true cover of native species in the wetland is within 20% of the estimated value.

#### Success Standard 4

Both the scrub-shrub and forested wetland should have 90% native species (2002).

#### Success Standard 5

All trees planted in the forested zone should have 90% viability (2002).

#### Success Standard 6

Scrub-shrub and forested wetland classes will be present. An increase in wildlife species should be observable (2002).

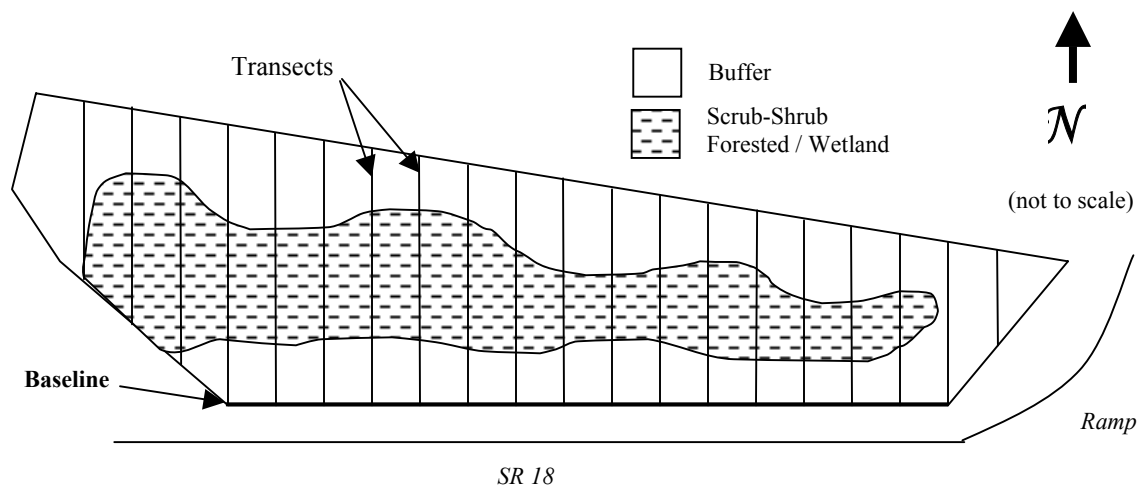
#### Success Standard 7

The buffer width will range from 10 to 50 ft as shown on design plans, and be measurable (2002).

### **Methods**

To evaluate woody cover of trees and shrubs on site, 19 temporary transects were placed perpendicular to a baseline across wetland and buffer areas using a systematic random sampling method (Figure 5.1).





**Figure 5.1 SR 18 Pumpkin Patch Mitigation Site Sampling Design (2002)**

Woody cover requirements in Success Standards 1, 2, and 3 were addressed using the line-intercept method. To measure Success Standards 1 and 2, 50 line-segment sample units 25-m in length were located along sampling transects. To measure Success Standard 3, 38 sample units 14-m in length were randomly located along sampling transects.

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objective and the desired level of statistical confidence. The following sample size equation was used to perform this analysis on the collected data.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>21</sup>  
n = unadjusted sample size

To address Success Standard 4 the percent native species in the scrub-shrub and forested wetland was derived using the raw data records from 2002. The number of native species in the scrub-shrub and forested wetland was divided by the total number of woody species.

Viability (survival) in Success Standard 5 was not addressed in 2002. Viability assessments after 5 years of site development are considered unreliable. Plant mortality and natural recruitment often confound results if viability is monitored long after initial plant establishment.

To address wildlife in Success Standard 6, three bird surveys were conducted between mid-May and early July in 2000, 2001, and 2002. Species richness, relative abundance,

<sup>21</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

and incidental wildlife observations were recorded. Species diversity indices (H) were calculated for each bird survey using the Shannon-Wiener function (Krebs 1999).

$$H' = -\sum_{i=1}^s (p_i)(\log p_i)$$

$H'$  = index of species diversity  
 $s$  = number of species  
 $p_i$  = proportion of sample belonging to  $i$ th species

To determine if an increase in bird diversity occurred from 2000 to 2002, a one-tailed t-test ( $\alpha = 0.025$ ) was performed between the species diversity indices of both years.

The buffer width requirement in Success Standard 7 was measured by recording the width of the buffers on each of the 19 temporary transects spanning the site. An average was calculated from these widths.

For additional details regarding the monitoring methods employed at this site, see the Methods section of this report.

## Results and Discussion

The SR 18 Pumpkin Patch mitigation site has developed exceptionally well over its five year monitoring period. The site is now characterized by a diverse community of dense scrub-shrub and forested woody vegetation with vertical stratification as shown in Figure 5.2. All fifth year success standards have been achieved within the five-year monitoring period. Results and a brief discussion pertaining to each success standard follows.



**Figure 5.2 Pumpkin Patch Mitigation Site (July 2002)**

### Success Standard 1 –35-50% Scrub-Shrub Cover and 2 Species Each With 30% Cover

The estimated aerial cover of scrub-shrub vegetation in the wetland is 43% ( $CI_{90\%} = 36-50\%$  aerial cover). *Cornus sericea* (redosier dogwood) and *Physocarpus capitatus* (Pacific ninebark) each contribute 46% relative cover. These data confirm that Success Standard 1 has been achieved. Other native scrub-shrub species in the wetland include *Acer circinatum* (vine maple), *Rubus spectabilis* (salmonberry), and *Symphoricarpos albus* (common snowberry) (Table 5.3).

### Success Standard 2 –50-80% Forested Cover and 2 Species Each With 40% Cover

The aerial cover estimate of woody vegetation in the wetland is 92% ( $CI_{95\%} = 83-101\%$  aerial cover). *Alnus rubra* (red alder) provides 41% relative cover and *Salix lucida* (Pacific willow) provides 40% relative cover achieving Success Standard 2. Other native tree species in the wetland include *Fraxinus latifolia* (Oregon ash), *Picea sitchensis*

(Sitka spruce), *Salix sitchensis* (Sitka willow), and *Thuja plicata* (western red cedar) (Table 5.3).

#### Success Standard 3 – Buffer: 50-75% Aerial Cover of Native Species

The estimated aerial cover of all native trees and shrubs in the buffer achieved the standard at 72% (CI<sub>95%</sub> = 65-79% aerial cover). Species and structural diversity are high with twelve native trees and shrubs represented.

#### Success Standard 4 - 90% Native Species in the Wetland

Fourteen woody species were encountered in the wetland during data collection, and 100% are native, thus achieving Success Standard 4. These species are listed in Table 5.3.

**Table 5.3 SR 18 Pumpkin Patch Mitigation Site Woody Species Encountered in the Wetland Zone**

Scientific Name	Common Name	Type	Nativity
<i>Acer circinatum</i>	vine maple	Tree	Native
<i>Alnus rubra</i>	red alder	Tree	Native
<i>Cornus sericea</i>	redosier dogwood	Shrub	Native
<i>Fraxinus latifolia</i>	Oregon ash	Tree	Native
<i>Picea sitchensis</i>	Sitka spruce	Tree	Native
<i>Physocarpus capitatus</i>	Pacific ninebark	Shrub	Native
<i>Rosa</i> sp.	roses	Shrub	Native
<i>Salix lucida</i>	Pacific willow	Tree	Native
<i>Salix sitchensis</i>	Sitka willow	Tree	Native
<i>Salix</i> sp.	willows	Tree	Native
<i>Rubus spectabilis</i>	salmonberry	Shrub	Native
<i>Spiraea douglasii</i>	hardhack	Shrub	Native
<i>Symphoricarpos albus</i>	common snowberry	Shrub	Native
<i>Thuja plicata</i>	western red cedar	Tree	Native

#### Success Standard 5- 90% Viability of Trees Planted in the Forested Zone

Success Standard 5 was not addressed in 2002. Viability (survival) assessments after 5 years of site development are considered unreliable. When planted material dies, it soon disappears and is not recognized and accounted for in data records thus inflating survival estimates. Because of the robust development of scrub-shrub and forested vegetation on this site, viability does not appear to be a concern.

#### Success Standard 6 - Scrub-Shrub and Forested Wetland Classes Present and Increase in Wildlife Species

An objective for this site is to provide wildlife habitat, with a standard requiring development of differing habitat types and vegetation canopy levels. This site has developed these intended characteristics. A diverse and stratified vegetative community is comprised of a 2 to 4-m scrub-shrub component dominated by *C. sericea* and *P. capitatus* with a forested overstory exceeding 6 meters composed of *Salix* spp, *A. rubra*, and *F. latifolia*. An estimated cumulative cover value of 94% (CI<sub>90%</sub> = 83-103% cover) for woody species in the wetland area compared to the aerial cover value of 73% (CI<sub>90%</sub> = 65-79% aerial cover) demonstrates this layering in the woody canopy.

Statistical analysis of bird species diversity from point count survey records shows no statistically significant increase between 2000 and 2002.<sup>22</sup> However, there is a noticeable difference in the total number of bird species observed on site in 1998 versus 2002. Twelve species were observed in 1998 and 22 were observed in 2002. Data records also indicate a high number of birds and other wildlife have been observed on site throughout the 5-year monitoring period. Thirty-two species of birds representing 18 avian families were observed on, or adjacent to the mitigation site. Six of these species are considered wetland-dependant including Belted Kingfisher (*Ceryle alcyon*), Canada Goose (*Branta canadensis*), Common Yellowthroat (*Geothlypis trichas*), Great Blue Heron (*Ardea herodias*), Mallard (*Anas platyrhynchos*), and Red-winged Blackbird (*Agelaius phoeniceus*).<sup>23</sup> In addition, red-legged frogs (*Rana aurora*), Pacific chorus frog (*Pseudacris regilla*), garter snakes (*Thamnophis* sp.), small mammals, and deer scat were observed on site during monitoring visits. Overall, this site's high woody cover, diversity of vegetation, stratified canopy layers, and seasonal standing water combine to provide habitat for a diverse community of wildlife.

#### Success Standard 7 –Buffer Width Average 10 to 50 feet

The average width of the buffer measured on each end of 19 transects was 48 ft. The buffer width and the condition of buffer vegetation are developing as intended.

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<sup>22</sup> Statistical analysis was performed using data gathered in year 2000 and after due to a bird survey protocol modification implemented in 2000.

<sup>23</sup> Birds are assigned an upland or wetland-dependent species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

## SR 18 Issaquah-Hobart, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 18 Issaquah-Hobart mitigation site in July 2002. Monitoring data were obtained to address fifth year success standards. Activities included surveys of herbaceous and woody vegetation. Table 6.1 provides general site information and Table 6.2 shows this year's monitoring results.

**Table 6.1 General Site Information for the SR 18 Issaquah-Hobart Mitigation Site**

<b>Project Name</b>	SR 18 Issaquah-Hobart Interchange and Raging River Bridge
<b>Contract Number</b>	BP MS4100
<b>USACE Permit Number</b>	94-4-00203
<b>Mitigation Location</b>	Issaquah-Hobart Interchange at SR 18, King County
<b>Township/Range/Section (impact)</b>	T.22N/R.6E/S.1, 2, T.23N/R.6E/S.36, T.23N/R.7E/S.31, and T.23N/R.7E/S.10, 15
<b>Monitoring Period</b>	1998 to 2002
<b>Year of Monitoring</b>	5 of 5
<b>Area of Project Impact</b>	0.85 ha (2.09 ac)
<b>Type of Mitigation</b>	Wetland Creation/Enhancement
<b>Area of Mitigation</b>	3.80 ha (9.46 ac)

**Table 6.2 Monitoring Summary from the SR 18 Issaquah-Hobart Mitigation Site**

Performance Criteria	2002 Results <sup>24</sup>
<b>Success Standards</b>	
1. $\geq 80\%$ woody cover in the wetland	39% (CI <sub>80%</sub> = 31-47% cover)
2. $\geq 75\%$ woody cover in the buffer (restoration)	15% (CI <sub>80%</sub> = 12-18% cover)
3. Difference in height between trees and shrubs	Yes
<b>Contingency Plan</b>	
4. $\leq 10\%$ invasive cover in the wetland	29% (CI <sub>80%</sub> = 23-35% cover)
5. $\leq 10\%$ invasive cover in the buffer (restoration)	17% (CI <sub>80%</sub> = 14-20% cover)

### Success Standards and Sampling Objectives

Fifth year success standards for the SR 18 Issaquah-Hobart mitigation site were excerpted from the *SR 18 Issaquah-Hobart Interchange and Raging River Bridge Wetland Mitigation Plan* (Aberle and Savage 1993). Sampling objectives follow the

<sup>24</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 39% (CI<sub>80%</sub> = 31-47% cover) means we are 80% confident that the true aerial cover value is between 31% and 47%.

success standard where appropriate. Appendix E provides the complete text of the success standards for this project.

#### Success Standard 1

The wetland should have 80% areal (*sic*) cover of woody wetland vegetation (2002).

##### Sampling Objective 1

To be 80% confident the true aerial cover of FAC and wetter woody vegetation in the wetland is within 20% of the estimated cover value.

#### Success Standard 2

Upland and riparian forested buffer restoration areas should have 75% areal (*sic*) cover of woody species (2002).

##### Sampling Objective 2

To be 80% confident the true aerial cover of woody species in the upland and riparian forested buffer restoration areas is within 20% of the estimated cover value.

#### Success Standard 3

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed (2002).

#### Contingency Plan

Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. A weed control program will be implemented if more than 10 percent of the wetland is invaded by invasive exotic species (2002).

##### Contingency Sampling Objective 1

To be 80% confident the true aerial cover of invasive exotic species in the wetland is within 20% of the estimated cover value.

##### Contingency Sampling Objective 2

To be 80% confident the true aerial cover of invasive exotic species in the upland and riparian forested buffer restoration areas is within 20% of the estimated cover value.

### **Methods**

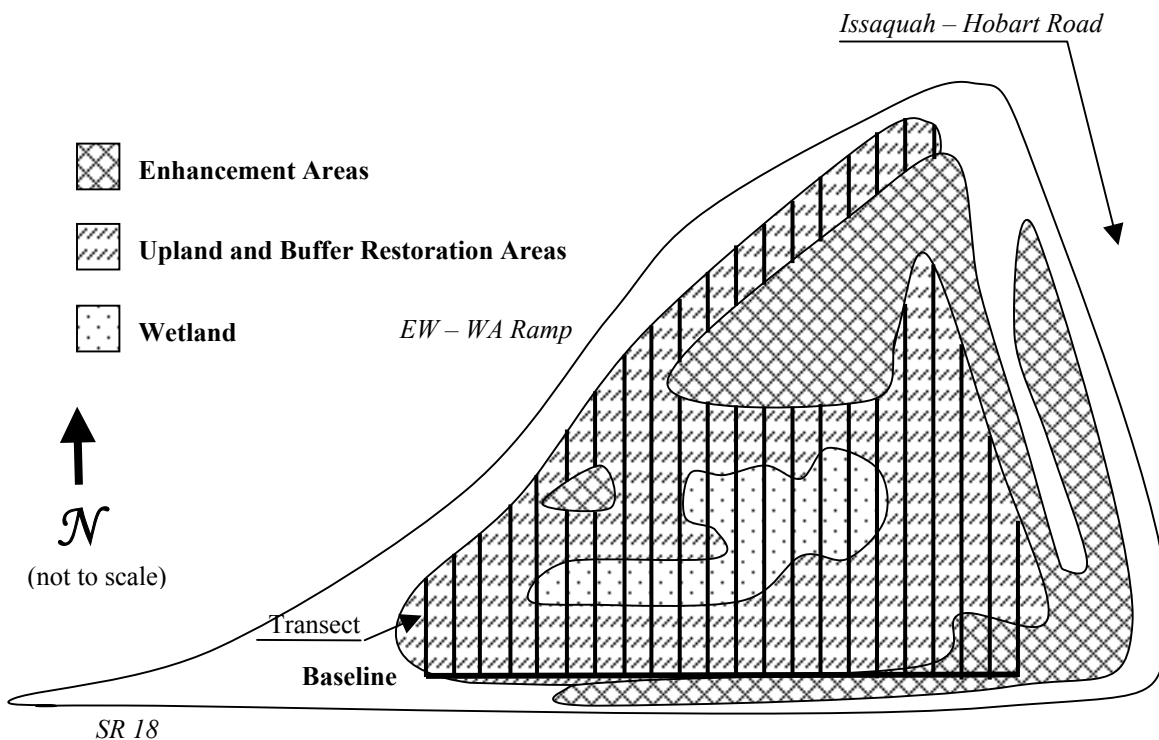
To evaluate the cover of both woody and herbaceous vegetation, 23 temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 6.1).

To address Success Standard 1 and 2, tree and shrub species cover data were collected using the line-intercept method in the wetland and also in the upland and buffer restoration areas. Data were collected on 29 7-m line-segment sample units in the

wetland and 58 20-m line-segment sample units in the upland and buffer restoration areas. These sample units were randomly located along sampling transects.

To address habitat stratification (Success Standard 3), the heights of the woody species in the wetland, upland, and buffer restoration areas were measured to the nearest 0.5 m while collecting line-intercept data. A 2-tailed t-test assuming unequal variances ( $\alpha = 0.05$ ) was conducted to determine if there was a significant difference between the shrub and the tree heights.

The point-line method was used in the wetland, upland and buffer restoration areas to collect aerial cover data for invasive species (Contingency). Sixty-three 7-m point-line sample units (28 points per unit) were randomly positioned in the wetland zone. Fifty-one 20-m point-line sampling units (80 points per unit) in the upland and buffer restoration areas were randomly located along sampling transects.



**Figure 6.1 SR 18 Issaquah-Hobart Mitigation Site Sampling Design (2002)**

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objective and the desired level of statistical confidence. The following sample size equation was used to perform this analysis on the collected data.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>25</sup>  
n = unadjusted sample size

For additional details on the methods described above, see the Methods section of this report.

## Results and Discussion

### Success Standard 1 – At Least 80% Wetland Woody Cover in the Wetland

The aerial cover of FAC and wetter tree and shrub species in the wetland is estimated to be 39% (CI<sub>80%</sub> = 31-47% cover) (Figure 6.2). This estimate is below the requirement for year five.

### Success Standard 2 – 75% Woody Cover in the Upland and Buffer Restoration Areas

In the upland and buffer restoration areas, the aerial cover of tree and shrub species is estimated to be 15% (CI<sub>80%</sub> = 12-18% cover). The requirement for year five in the buffer was not met. If the coverage of trees is less than 50% after the third growing season the contingency plan provides for replanting. The Northwest Region is planning to replant some woody species in 2002.

### Success Standard 3 – Difference in Height Between Trees and Shrubs

Habitat structure is starting to change from a single layer to multiple layers as the woody vegetation matures (Figure 6.2). The median tree height is 4 m and the median shrub height is 2 m (Tables 6.3 and 6.4). Additionally, there appears to be a statistically significant difference between the mean heights of the shrub (2.1m) and tree (4.1m) layers ( $P < 0.01$ ), thus meeting the requirement.



**Figure 6.2 18 Issaquah-Hobart Mitigation Site (July 2002)**

<sup>25</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.



**Table 6.3 Median Tree Heights on the SR 18 Issaquah-Hobart Wetland Mitigation Site**

Scientific Name	Common Name	Median Height (m)
<i>Alnus rubra</i>	red alder	6
<i>Fraxinus latifolia</i>	Oregon ash	4
<i>Tsuga heterophylla</i>	western hemlock	4
<i>Pseudotsuga menziesii</i>	Douglas-fir	3.5
<i>Thuja plicata</i>	western red cedar	3
<b>All Tree Species</b>		<b>4</b>

**Table 6.4 Median Shrub Heights on the SR 18 Issaquah-Hobart Wetland Mitigation Site**

Scientific Name	Common Name	Median Height (m)
<i>Acer circinatum</i>	vine maple	2
<i>Cornus sericea</i>	redosier dogwood	2
<i>Lonicera involucrata</i>	twinberry	2
<i>Rubus parviflorus</i>	thimbleberry	0.5
<i>Rubus spectabilis</i>	salmonberry	1
<i>Sambucus racemosa</i>	red elderberry	3
<i>Salix sitchensis</i>	Sitka willow	3
<i>Symphoricarpos albus</i>	common snowberry	1
<b>All Shrub Species</b>		<b>2</b>

Contingency – Less Than 10% Cover by Invasive Exotic Species

Survey results indicate that invasive exotic species exceed the threshold with an estimated aerial cover value of 29% (CI<sub>80%</sub> = 23-35% cover) in the wetland and 17% (CI<sub>80%</sub> = 14-20% cover) in the upland and buffer restoration areas. If more than 10% of the wetland is invaded by invasive exotic species, a weed control program is specified in the contingency. The Northwest Region is planning to perform weed control in 2002.

The following invasive species were observed on the mitigation site:

- *Cirsium arvense* (Canada thistle)
- *Cirsium vulgare* (bull thistle)
- *Phalaris arundinacea* (reed canarygrass)
- *Rubus armeniacus* (Himalayan blackberry)
- *Rubus laciniatus* (cutleaf blackberry)
- *Senecio jacobaea* (tansy ragwort)
- *Geranium robertianum* (stinky Bob)
- *Sonchus asper* (spiny sowthistle)

## SR 18 Kendal, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 18 Kendal mitigation site in August 2002. Monitoring data were obtained to compare to fifth year success standards and the contingency plan. Activities included vegetation and bird surveys. Table 7.1 provides general site information for the SR 18 Kendal mitigation site, and Table 7.2 summarizes this year's monitoring results.<sup>26</sup>

**Table 7.1 General Site Information for the SR 18 Kendal Mitigation Site**

<b>Project Name</b>	SR 18 312 <sup>th</sup> Way to Covington Way	
<b>Contract Number</b>	GD MS4091	
<b>USACE Permit Number</b>	95-4-00203	
<b>Mitigation Location</b>	Northwest of SR 18, east of 156 <sup>th</sup> Ave. SE, King County	
<b>Township/Range/Section (impact)</b>	T.21N/R.6E/S.3 & 10 and T.22N/R.6E/S.35	
<b>Monitoring Period</b>	1998 to 2002	
<b>Area of Project Impact<sup>27</sup></b>	Wetland 0.07 ha (1.77ac)	Buffer 0.82 ha (2.05 ac)
<b>Type of Mitigation</b>	Wetland Creation	Wetland Enhancement
<b>Area of Mitigation</b>	0.72 ha (1.8 ac)	0.65 ha (1.64 ac)
<b>Type of Mitigation</b>	Wetland Buffer Creation	
<b>Area of Mitigation</b>	0.77 ha (1.91 ac)	

**Table 7.2 Monitoring and Management Summary from the SR 18 Kendal Mitigation Site**

<b>Performance Criteria</b>	<b>2002 Results<sup>28</sup></b>	<b>Management Activities</b>
<b>Success Standards</b>		
1. ≥ 80% aerial cover of woody wetland vegetation in the wetland	30% (CI <sub>90%</sub> = 25-37% cover)	Replanted in 12/02
2. ≥ 75% aerial cover of woody vegetation in the buffer area	32% (CI <sub>80%</sub> = 26-38% cover)	Replanted in 12/02
3. ≥ 80% aerial cover of woody plants on the site	36% (CI <sub>90%</sub> = 31-41% cover)	Replanted in 12/02
4. Observable height differences between shrubs and trees	Significant difference ( $P < 0.01$ )	Replanted in 12/02
<b>Contingency Plan</b>		
5. < 10% aerial cover of invasive species	25% (CI <sub>80%</sub> = 20-30% cover)	

<sup>26</sup> Results reflect data collected prior to an accidental maintenance activity that decreased woody vegetation on approximately 1 acre of the site. Woody cover percentages presented are higher than current site conditions. Replacement plantings were installed in December 2002. The City of Kent has required 3 additional years of monitoring.

<sup>27</sup> SR 18 Kendal provides partial compensation for impacts from the SR 18 SE 304<sup>th</sup> Street to Covington Way project. The SR 516 Bartol site provides the remaining compensation for the project.

<sup>28</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 30% (CI<sub>90%</sub> = 25-37% aerial cover) means we are 90% confident that the true aerial cover value is between 25% and 37%.

## **Success Standards and Sampling Objectives**

Fifth year success standards and the contingency measure for the SR 18 Kendal mitigation site were excerpted from the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1994). Sampling objectives follow the success standards and contingency measure where appropriate. Appendix F provides the complete text of the success standards and contingency measure for this project.

### Success Standard 1

The wetland should have 80% areal (*sic*) cover of forested and scrub-shrub wetland vegetation (2002).

#### Sampling Objective 1

To be 80% confident the true aerial cover of woody wetland vegetation (FAC and wetter) in the wetland is within 20% of the estimated value.

### Success Standard 2

Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 75% or greater cover (2002).

#### Sampling Objective 2

To be 80% confident the true aerial cover of native woody species in the upland and riparian forested buffer is within 20% of the estimated value.

### Success Standard 3

The mitigation site should have 80% areal (*sic*) cover of trees and shrubs (2002).

#### Sampling Objective 3

To be 80% confident the true aerial cover of woody species on the entire site is within 20% of the estimated value.

### Success Standard 4

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed (2002).

#### Sampling Objective 4

To detect a significant difference ( $\alpha = 0.05$ ) between the heights of shrubs and trees.

### Contingency Plan 5

A weed control plan will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2002).

#### Contingency Sampling Objective

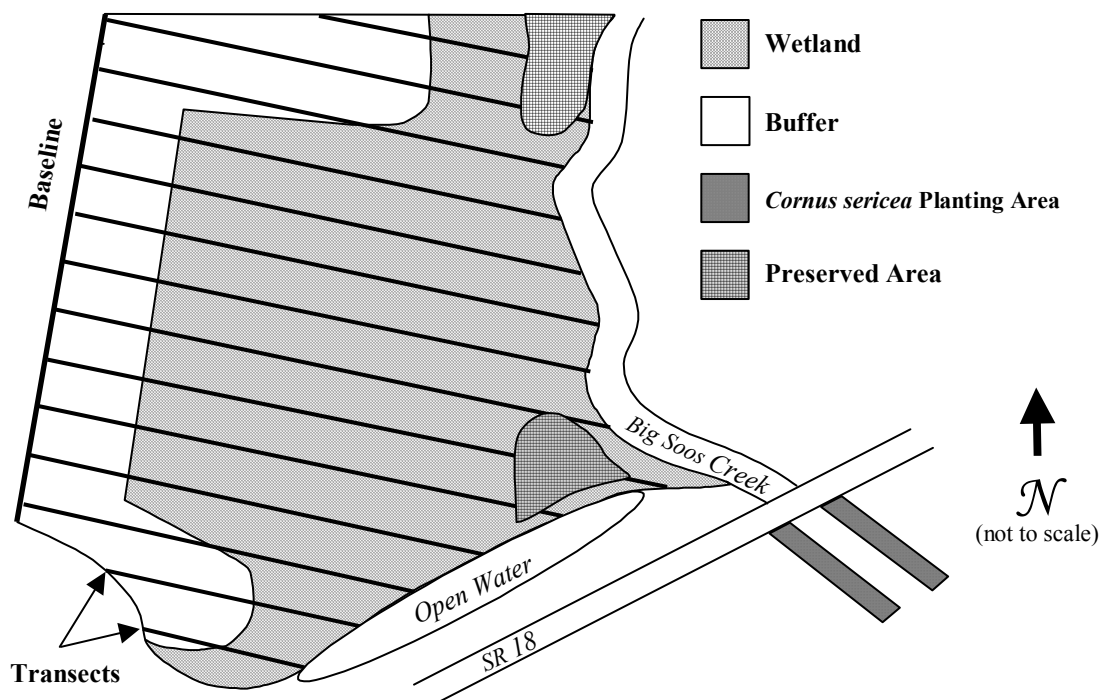
To be 80% confident the true aerial cover for invasive exotic species on the entire site is within 20% of the estimated aerial cover value.

## Methods

To evaluate the cover of woody and invasive exotic vegetation, 23 transects were placed perpendicular to a baseline along the west side of the site using a systematic random sampling method (Figure 7.1). The preserved wetland area was not monitored.

To address woody cover for Success Standards 1, 2, and 3, the line-intercept method was used. Line-segment sample units were randomly located along sampling transects. Data were collected in the wetland on 77 sample units 20 m in length. To address Success Standards 1, 2, and 3, pertinent subsets of this data were analyzed.

To address the Contingency Plan, the point-line method was used to assess cover of invasive exotic species on the entire site. Aerial cover data were collected along 101 point-line sample units 20 m in length, randomly located along sampling transects in the upland buffer and wetland areas. Data were obtained at 80 point locations on each sample unit.



**Figure 7.1** SR 18 Kendal Mitigation Site Sampling Design (2002)

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objectives and the desired level of statistical confidence.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>29</sup>  
n = unadjusted sample size

Habitat structure (Success Standard 4) was addressed in the entire site both qualitatively through photographs, and quantitatively. In addition to line-intercept data, the heights of individual trees and shrubs intercepting the sample units were recorded to the nearest 0.5 m along each line-segment sample unit mentioned above. A two-tailed t-test assuming unequal variances ( $\alpha = 0.05$ ) was conducted to determine if there was a significant difference between the shrub and the tree layer heights.

Three bird surveys were conducted between mid-May and early July to be used for evaluation of the site's wildlife. Family and species richness, as well as relative abundance were recorded.

## Results and Discussion

### Success Standard 1 – At Least 80% Wetland Woody FAC and Wetter Vegetation

The aerial cover of woody FAC and wetter species was estimated to be 30% ( $CI_{90\%} = 25\text{-}37\%$  cover) (Figure 7.2). Woody FAC and wetter species observed are identified in Table 8.3. This value does not meet the fifth year Success Standard 1. Re-planting of 5-gallon trees and shrubs in December 2002 should add to the cover in this zone.



**Figure 7.2** SR 18 Kendal Mitigation Site Wetland Zone (August 2002)

### Success Standard 2 - At Least 75% Woody Cover in the Buffer Area

The aerial cover of woody species was estimated at 32% ( $CI_{80\%} = 26\text{-}38\%$  cover) in the upland buffer area. This estimated value does not meet the fifth year Success Standard 2. Woody species observed in this zone are identified in Table 7.4.

<sup>29</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

**Table 7.3. SR 18 Kendal Woody FAC and Wetter Species in the Wetland**

<i>Acer circinatum</i> (vine maple)	<i>Thuja plicata</i> (western red cedar).
<i>Alnus rubra</i> (red alder)	<i>Spiraea douglasii</i> (hardhack)
<i>Cornus sericea</i> (redosier dogwood)	<i>Salix sitchensis</i> (Sitka willow)
<i>Fraxinus latifolia</i> (Oregon ash)	<i>Salix scouleriana</i> (Scouler's willow)
<i>Lonicera involucrata</i> (twinberry)	<i>Salix lucida</i> (Pacific willow)
<i>Physocarpus capitatus</i> (Pacific ninebark)	<i>Rubus spectabilis</i> (salmonberry)
<i>Populus balsamifera</i> (black cottonwood)	<i>Rubus parviflorus</i> (thimbleberry)

**Table 7.4. SR 18 Kendal Woody FAC and Wetter Species in the Buffer**

<i>Acer circinatum</i> (vine maple)	<i>Thuja plicata</i> (western red cedar).
<i>Pseudotsuga menziesii</i> (Douglas-fir)	<i>Spiraea douglasii</i> (hardhack),
<i>Cornus sericea</i> (redosier dogwood)	<i>Salix sitchensis</i> (Sitka willow),
<i>Fraxinus latifolia</i> (Oregon ash)	<i>Symphoricarpos albus</i> (common snowberry)
<i>Lonicera involucrata</i> (twinberry)	<i>Salix lucida</i> (Pacific willow)
<i>Physocarpus capitatus</i> (Pacific ninebark)	<i>Rubus spectabilis</i> (salmonberry)
<i>Populus balsamifera</i> (black cottonwood)	<i>Rubus parviflorus</i> (thimbleberry)
<i>Sambucus racemosa</i> (red elderberry)	

**Success Standard 3 – At Least 80% Woody Cover on the Entire Site**

Success Standard 3 was addressed by analyzing woody species cover data for the entire site, upland buffer combined with the wetland. The aerial cover of woody species was estimated at 36% (CI<sub>90%</sub> = 31-41% cover). This estimated cover value does not meet the fifth year Success Standard 3.

**Success Standard 4 -  
Observable Differences in  
Height between Shrub and  
Tree Layers**

There was an observable height difference between the shrub and the tree canopy layers, meeting the requirements of Success Standard 4. Photographic documentation (Figure 7.3) illustrates the quantitative differences between the height of the shrub and tree layers. Additionally, there appears to be a statistically significant difference between the mean heights of the shrub (2.6 m) and tree (3.2 m) layers ( $P = 0.002$ ), thus meeting the standard.

**Figure 7.3 SR 18 Kendal Upland Buffer (August 2002)**

#### Contingency Plan – Less than 10% Invasive Exotic Species Cover

The estimated aerial cover of invasive exotic species was 25% ( $CI_{80\%} = 20\text{--}30\%$  cover) on the entire site. Invasive exotic species observed on the site included *P. arundinacea*, *Rubus armeniacus* (Himalayan blackberry), and *Cirsium vulgare* (bull thistle). These species were mostly concentrated around the edges of the site. Because the cover estimates exceed the limit, the weed control contingency plan is triggered.

Objective 2 states that the site should provide additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. Twenty-five bird species were observed, five of which were wetland-dependent and three of which were wetland-associated (Table 7.5). Fifteen avian families were represented on the site. Incidental observations were made of unidentified small rodents, Pacific chorus frogs (*Hyla regilla*), and unidentified garter snakes (*Thamnophis* sp.).

**Table 7.5 SR 18 Kendal Mitigation Site Bird Species Status (2002).**

Common Name	Scientific Name	Status <sup>30</sup>
Barn Swallow	<i>Hirundo rustica</i>	Wetland-associated
Canada Goose	<i>Branta canadensis</i>	Wetland-dependant
Common Yellowthroat	<i>Geothlypis trichas</i>	Wetland-dependant
Mallard	<i>Anas platyrhynchos</i>	Wetland-dependant
Marsh Wren	<i>Cistothorus palustris</i>	Wetland-dependant
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Wetland-dependant
Violet-green Swallow	<i>Tachycineta thalassina</i>	Wetland-associated
Willow Flycatcher	<i>Empidonax traillii</i>	Wetland-associated

#### Management Activities

The above results for woody and invasive cover reflect data collected prior to an accidental maintenance activity in the fall of 2002 that decreased herbaceous and woody vegetation on approximately 1 acre of the site. Woody cover percentages presented are higher than current site conditions. Replacement plantings were installed in December 2002.

<sup>30</sup> Birds are assigned an upland or wetland-dependent species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

## SR 99 First Avenue South Bridge, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 99 First Avenue South Bridge mitigation site in August 2002. Monitoring data were obtained to address fifth year success standards. Activities included surveys of invasive, emergent and upland vegetation and measurements of the buffer width. Table 8.1 provides general site information and Table 8.2 shows this year's monitoring results.

**Table 8.1 General Site Information for the SR 99 First Avenue South Mitigation Site**

<b>Project Name</b>	SR 99 First Avenue South Bridge Project
<b>USACE Permit Number</b>	93-2-01249
<b>Mitigation Location</b>	First Avenue Bridge over Duwamish River, King Co.
<b>Township/Range/Section (impact)</b>	T.24N/R.4E/S.29 (SW1/4), 30 (SE1/4)
<b>Monitoring Period</b>	1998 to 2002
<b>Year of Monitoring</b>	5 of 5
<b>Area of Project Impact</b>	0.42 ha (1.04 ac)
<b>Type of Mitigation</b>	Creation and Enhancement
<b>Area of Mitigation</b>	0.84 ha (2.08 ac)

**Table 8.2 Monitoring and Management Summary SR 99 First Avenue South Mitigation Site**

Performance Criteria	2002 Results <sup>31</sup>	Management Activities
<b>Success Standards</b>		
1. $\geq 75\%$ cover by FAC or wetter native emergent vegetation	85% (CI <sub>90%</sub> = 79-91% cover)	
2. $\geq 75\%$ cover by woody species in the upland forested/shrub buffer	36% (CI <sub>80%</sub> = 29-43% cover)	Planned replanting and soil amendment (2003)
3. Buffer width will average between 30-50 ft	Yes	
4. Difference in height between trees, shrubs and emergents	Yes	
5. The wetland system will be tidally inundated twice a day	Yes	
<b>Contingency Plan</b>		
6. $< 10\%$ aerial cover of invasive exotic species	14% (CI <sub>80%</sub> = 10-18% cover)	Planned weed control (2003)

<sup>31</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 85% (CI<sub>90%</sub> = 79-91% cover) means we are 90% confident that the true aerial cover value is between 79% and 91%.



## **Success Standards and Sampling Objectives**

Fifth year success standards for the SR 99 First Avenue South mitigation site were excerpted from the *First Avenue South New Bridge Project Detailed Wetland Mitigation Plan* (Aberle and Clay-Poole 1994). Sampling objectives follow the success standard where appropriate. Appendix G provides the complete text of the success standards for this project.

### Success Standard 1

The wetland has 75-80% cover by emergent vegetation of facultative or wetter species (2002).

#### Sampling Objective 1

To be 80% confident the true aerial cover of FAC and wetter emergent vegetation in the wetland is within 20% of the estimated cover value.

### Success Standard 2

Emergent wetland has 75% or greater dominance of native species (2002).

#### Sampling Objective 2

To be 80% confident the true aerial cover of native species within the emergent wetland is within 20% of the estimated cover value.

### Success Standard 3

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees, shrubs and emergents mature (2002).

### Success Standard 4

The wetland system will be dominated by emergent vegetation and will be tidally inundated twice each day (2002).

### Success Standard 5

The mitigation site should have 75-80% cover by emergent vegetation of FAC or wetter species (2002).

#### Sampling Objective 5

To be 80% confident the true aerial cover of FAC and wetter emergent vegetation in the wetland is within 20% of the estimated cover value.

### Success Standard 6

Upland forested/shrub buffer area should have 75% cover by species planted, or be supplemented or replaced by a native naturally colonizing upland plant community at 75% or greater cover (2002).

#### Sampling Objective 6

To be 80% confident the true aerial cover of native woody species in the upland forested/shrub buffer area is within 20% of the estimated cover value.

#### Success Standard 7

Buffer width will average between 30-50 feet. (2002).

#### Contingency Measure

A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species

#### Contingency Sampling Objective

To be 80% confident the true aerial cover of invasive exotic species is within 20% of the estimated cover value.

### **Methods**

To evaluate the cover of both woody and herbaceous vegetation, 31 temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 8.1).

Herbaceous cover (Success Standards 1, 2 and 5) was addressed using the point-line method in the emergent zone. Twenty-four 10-m point-line sample units were randomly located along every other sampling transect. Data were obtained at 40 point locations on each sample unit.

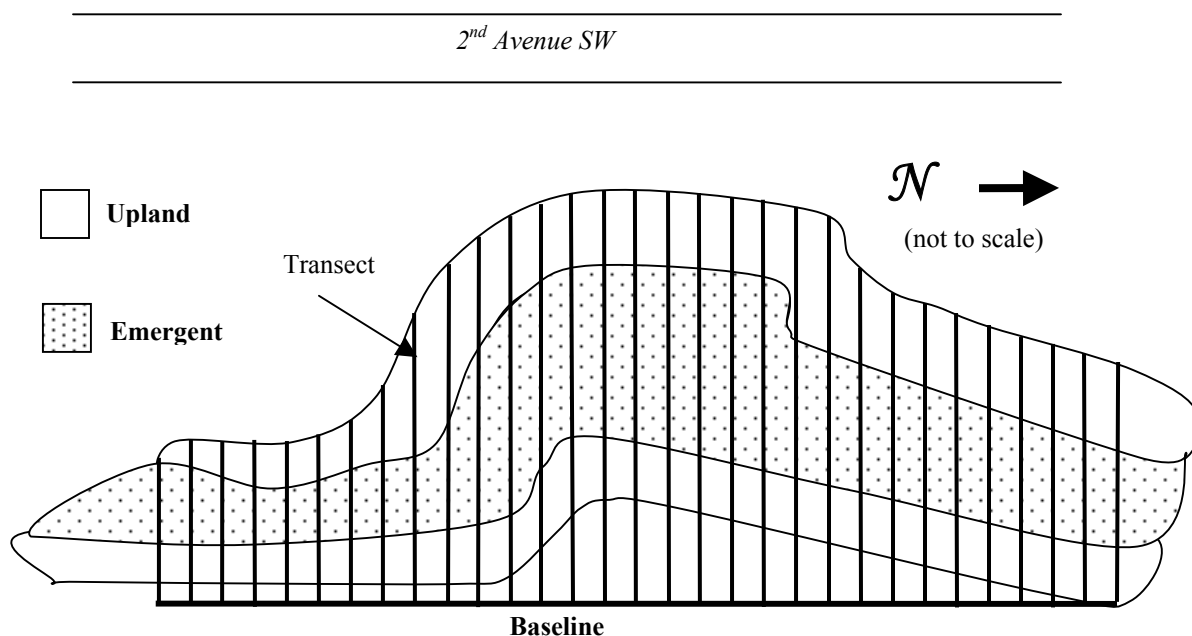
To address habitat stratification (Success Standard 3), photos were taken of the mitigation site.

Tidal Inundation (Success Standard 4) was addressed with general observations of high and low tide during site visits.

Tree and shrub species cover data (Success Standard 6) were collected using the line-intercept method in the upland forested/shrub buffer area. Data were collected on 21 20-m line-segment sample units randomly located along every other sampling transect.

While locating the sample units along the transects, the width of the buffer was measured to address Success Standard 7.

The point-line method was also used to evaluate cover of invasive exotic species against the threshold limit of 10% (Contingency). Forty-one 30-m sample units were used and randomly located along every sampling transect. Data were obtained at 120 point locations on each sample unit.



**Figure 8.1 SR 99 First Avenue South Mitigation Site Sampling Design (2002)**

Sample size analysis was conducted using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

$z$  = standard normal deviate  
 $s$  = sample standard deviation  
 $B$  = precision level<sup>32</sup>  
 $n$  = unadjusted sample size

Objective 2 addresses increasing wildlife habitat (Appendix G). Four bird surveys were conducted between mid-May and early July to provide additional information about wildlife use of the site. Species richness and relative abundance were recorded. Species diversity indices ( $H'$ ) were calculated for each bird survey using the Shannon-Wiener function (Krebs 1999).

$$H' = -\sum_{i=1}^s (p_i)(\log p_i)$$

$H'$  = index of species diversity  
 $s$  = number of species  
 $p_i$  = proportion of sample belonging to  $i$ th species

To determine if an increase in bird diversity occurred from 2000 to 2002, a one-tailed t-test ( $\alpha = 0.025$ ) was performed between the species diversity indices of both years.

For additional details on the methods described above, see the Methods section of this report.

<sup>32</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

## Results and Discussion

### Success Standards 1, 2 and 5 – 75% Native FAC and Wetter Cover in the Emergent Zone

The estimated aerial cover for native FAC and wetter species in the emergent area is 85% ( $CI_{90\%} = 79\text{-}91\%$  cover). This value exceeds the 75% cover requirement (Success Standard 1, 2 and 5). Overall, the emergent zone has developed as intended with well established FAC and wetter species. The native FAC and wetter species observed include: *Eleocharis parvula* (dwarf spikerush), *Schoenoplectus americanus* (American bulrush), *Agrostis exarata* (spike bentgrass), *Argentina anserina* (silverweed cinquefoil), *Grindelia integrifolia* (Puget Sound gumweed), *Symphotrichum subspicatum* (Douglas aster), and *Deschampsia caespitosa* (tufted hairgrass).

### Success Standard 3 – Multiple Layers in Habitat Structure

The habitat structure is starting to change from a single layer of vegetation to multiple layers as the trees, shrubs and emergent vegetation matures. Although the woody cover is developing slower than desired, multiple layers of vegetation can be observed throughout the site (Figure 8.2). Tree and shrub development is most prevalent on the north and south ends of the site.

### Success Standard 4 – Tidal Inundation

The emergent area is tidally inundated twice every day as required. Measurements of the width of the inundated area ranged from 5 to 36-m wide. The average width of the emergent area is 22 m.

Objective 2 addresses wildlife habitat diversity with Success Standards 3 and 4 (Appendix G). Bird surveys were conducted to provide additional information on actual wildlife use of the site. Even though there is not a statistically significant increase in bird species diversity from year 2000 to 2002, the results indicate that both the mean species richness and the mean family richness increased from year 2000 to 2002 (Table 8.3).

**Table 8.3 SR 99 First Avenue South Mitigation Site Bird Survey Results**

Attribute	Year 2000	Year 2001	Year 2002
Mean Species Richness	12 species	13 species	14 species
Mean Family Richness	10 avian families	10 avian families	11 avian families
Species Diversity Index			
Mean H'	0.8842	0.8701	0.5114
Standard Error	0.0640	0.0411	0.0539
Range	0.8066 – 1.0491	0.7939 – 0.9420	0.8129 – 1.0414

Norman Wildlife Consulting conducted bird banding four times from January through May in 2002. With bird surveys and banding data combined, a total of 40 bird species from 15 avian families were observed on the site over the monitoring period (1998-2002). Eleven of the 40 bird species are wetland-dependent and four are wetland-associated (Table 8.4). Based on these data, it appears that the site is providing habitat for a variety of bird species.

**Table 8.4 SR 99 First Avenue South Mitigation Site Bird Status**

Common Name	Scientific Name	Status <sup>33</sup>
Barn Swallow	<i>Hirundo rustica</i>	Wetland-associated
Belted Kingfisher	<i>Ceryle alcyon</i>	Wetland-dependent
Canada Goose	<i>Branta canadensis</i>	Wetland-dependent
Common Yellowthroat	<i>Geothlypis trichas</i>	Wetland-dependent
Gadwall	<i>Anas strepera</i>	Wetland-dependent
Great Blue Heron	<i>Ardea herodias</i>	Wetland-dependent
Green Heron	<i>Butorides striatus</i>	Wetland-dependent
Killdeer	<i>Charadrius vociferus</i>	Wetland-associated
Mallard	<i>Anas platyrhynchos</i>	Wetland-dependent
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Wetland-dependent
Sanderling	<i>Calidris alba</i>	Wetland-dependent
Spotted Sandpiper	<i>Actitis macularia</i>	Wetland-dependent
Warbling Vireo	<i>Vireo gilvus</i>	Wetland-associated
Western Sandpiper	<i>Calidris mauri</i>	Wetland-dependent
Wilson's Warbler	<i>Wilsonia pusilla</i>	Wetland-associated

Success Standard 6 – At Least 75% Cover by Trees and Shrubs in the Upland Forested/Shrub Buffer Area

Tree and shrub species in the upland forested/shrub buffer area provide 36% cover (CI<sub>80%</sub> = 29-43% cover) (Figure 8.2). This cover estimate is below the 75% cover requirement for year five. Replanting is planned to reach the 75% cover requirement in the future.



**Figure 8.2 SR 99 First Avenue South (August 2002)**

Success Standard 7 – 30-50 feet Average Buffer Width

The average buffer width is 55 ft. Width measurements ranged from 0 to 110 ft. This exceeds the requirement of an average width between 30 and 50 ft.

Contingency Plan – Less Than 10% Cover by Invasive Exotic Species

Cover of invasive exotic species was evaluated to determine if remediation would be necessary to bring the population of these species below the fifth year (2002) 10% cover threshold. Survey results indicate that the invasive exotic species presently exceed the threshold of 10% with an estimated aerial cover value on site of 14% (CI<sub>80%</sub>

<sup>33</sup> Birds are assigned an upland or wetland-dependent species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

= 10-18% cover) (Contingency). Ten invasive exotic species were observed on the mitigation site:

- *Rubus armeniacus* (Himalayan blackberry)
- *Rubus laciniatus* (cutleaf blackberry)
- *Phragmites australis* (common reed)
- *Lepidium latifolium* (broadleaved pepperweed)
- *Hypericum perforatum* (common St. Johnswort)
- *Cirsium arvense* (Canada thistle)
- *Cirsium vulgare* (bull thistle)
- *Cytisus scoparius* (scotchbroom)
- *Daucus carota* (Queen Anne's lace)

Patchy distribution of invasives is a problem throughout the site. *P. australis* occurs along the edge of the emergent area. *C. scoparius*, *T. vulgare* and *Rubus sp.* are the primary species of concern in the buffer. This site will benefit from planned weed control; however, complete eradication of *P. australis* may be difficult due to its prevalence in the surrounding landscape.

### **Management Activities**

Soil amendments and replanting are planned for spring of 2003. The soil amendments are intended to improve the growth rates of existing plants. Replanting will add more aerial cover of woody species on the mitigation site. Weed control is planned to include the removal of the invasive *P. australis*.

## SR 167 Mill Creek Stage 1A, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 167 Mill Creek Stage 1A mitigation site in July 2002. Monitoring data were obtained to address third year success standards. Activities included surveys of herbaceous and woody vegetation and an inventory of habitat structures. Table 9.1 provides general site information and Table 9.2 shows this year's monitoring results.

**Table 9.1 General Site Information for the SR 167 Mill Creek Stage 1A Mitigation Site**

<b>Project Name</b>	SR 167 84 <sup>th</sup> Ave S. to South Grady Way Stage 1A	
<b>Contract Number</b>	DB MS 3814	
<b>USACE Permit Number</b>	93-4-01100	
<b>Mitigation Location</b>	Southwest of SR 167 I/C with 15 <sup>th</sup> St. NW on West Valley Highway, King Co.	
<b>Township/Range/Section (impact)</b>	T.22N/R.05E/S.06	
<b>Monitoring Period</b>	2000 to 2004	
<b>Year of Monitoring</b>	3 of 5	
<b>Area of Project Impact</b>	1.60 ha (3.95 ac)	
<b>Type of Mitigation</b>	Wetland creation	Wetland enhancement
<b>Area of Mitigation</b>	0.46 ha (1.15 ac)	2.36 ha (5.84 ac)

**Table 9.2 Monitoring Summary from the SR 167 Mill Creek Stage 1A Mitigation Site**

<b>Performance Criteria</b>		<b>2002 Results<sup>34</sup></b>
1.	≥ 15% woody cover in the scrub-shrub zone	32% (CI <sub>90%</sub> = 27-37% cover)
2.	> 50% FACW or OBL cover in emergent	94% (CI <sub>99%</sub> = 89-99% cover)
3.	Habitat structures present	Yes

### Success Standards and Sampling Objectives

Third year success standards for the SR 167 Mill Creek 1A mitigation site were excerpted from the *84<sup>th</sup> Ave S. to South Grady Way Stage 1A SR 167 Detailed Wetland Mitigation Plan* (WSDOT 1997). Sampling objectives follow the success standard where appropriate. Appendix H presents the complete text of the success standards for this project.

<sup>34</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 32% (CI<sub>90%</sub> = 27-37% aerial cover) means we are 90% confident that the true aerial cover value is between 27% and 37%.

#### Success Standard 1<sup>35</sup>

There is greater than or equal to 15% cumulative aerial cover of trees and shrubs within the scrub-shrub wetland zones which include at least 4 native species (2002).

##### Sampling Objective 1

To be 80% confident the true aerial cover value of at least native 4 tree and shrub species in scrub-shrub wetland is within 20% of the true value.

#### Success Standard 2

The emergent wetland will have greater than or equal to 50% cover which is composed of a minimum of 3 FACW or OBL species (2002).

##### Sampling Objective 2

To be 80% confident that mean aerial cover value of at least 3 FACW or OBL species in the emergent zone is within 20% of the true value.

#### Success Standard 3

Three types of habitat structures will have been installed on the site; constructed raptor perches, brush piles and large woody debris or boulders. The total number of habitat structures shall be at least 10, with 2 of those structures being raptor perches.

#### Success Standard 4<sup>33</sup>

There is greater than or equal to 15% cumulative aerial cover of trees and shrubs within the buffer zone which include at least 4 native species (2002).

### **Methods**

To evaluate the cover of both woody and herbaceous vegetation, 18 temporary transects were placed perpendicular to a baseline using a systematic random sampling method (Figure 9.1).

To address Success Standard 1, tree and shrub species aerial cover data were collected using the line-intercept method in the scrub-shrub wetland area. Data were collected on 43 30-m line-segment sample units randomly located along sampling transects.

To assess aerial cover of woody and herbaceous species in the emergent wetland (Success Standard 2) the point-line method was used. Forty 20-m point-line sample units (80 points/unit) were randomly located along sampling transects.

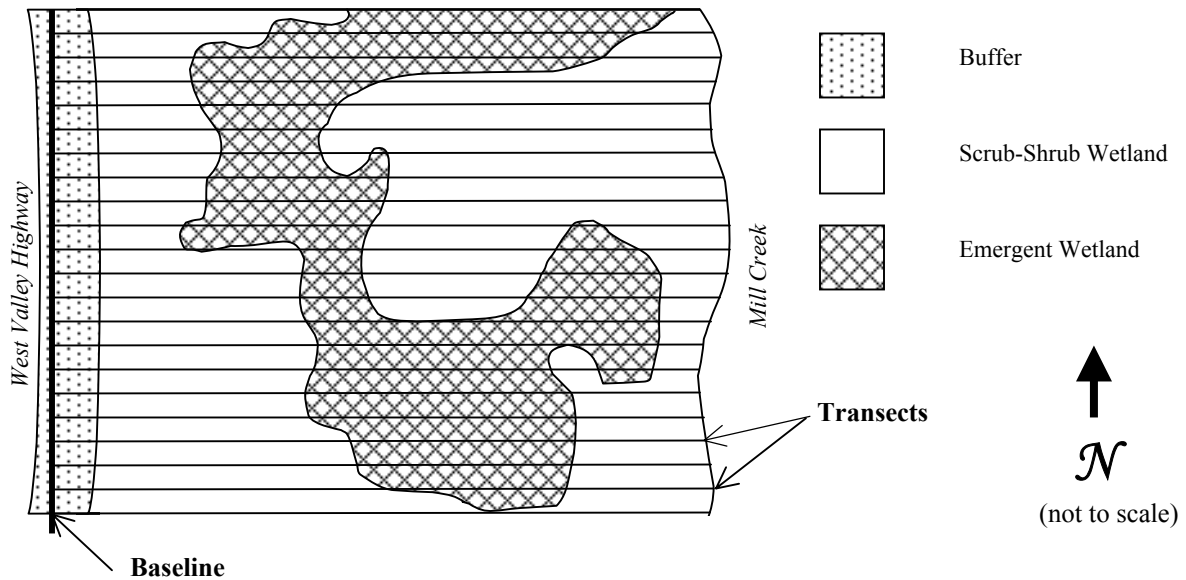
To address Success Standard 3 a total count of habitat structures was conducted.

Aerial cover of native woody species in the buffer (Success Standard 4) was evaluated qualitatively.

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<sup>35</sup> Aerial cover has been used instead of cumulative aerial cover since it is a more conservative measure and is specified in the other success standards for this site.





**Figure 9.1 SR 167 Mill Creek Stage 1A Mitigation Site Sampling Design (2002)**

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objective and the desired level of statistical confidence. The following sample size equation was used to perform this analysis on the collected data.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>36</sup>  
n = unadjusted sample size

## Results and Discussion

### Success Standard 1 – At Least 15% Tree and Shrub Cover in the Scrub Shrub Zone

Tree and shrub species in the scrub-shrub wetland zone provide an estimated 32% aerial cover ( $CI_{90\%} = 27\text{-}37\%$  cover) (Figure 9.2). This value exceeds the 15% cover requirement for year three. The species diversity criteria requiring at least four species to contribute to this cover is also achieved with 18 native tree and shrub species represented in line intercept data (Table 9.3). With continued development, tree and shrub cover will exceed the 35% cover requirement for year five.



**Figure 9.2 SR 167 Mill Creek Stage 1A Mitigation Site (July 2002)**

<sup>36</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

**Table 9.3 Native Tree and Shrub Species in the Scrub-Shrub Zone of SR 167 Mill Creek Stage 1A**

<i>Acer macrophyllum</i> (big-leaf maple)	<i>Pseudotsuga menziesii</i> (Douglas fir)
<i>Alnus rubra</i> (red alder)	<i>Frangula purshiana</i> (cascara)
<i>Cornus sericea</i> (red-osier dogwood)	<i>Rubus parviflorus</i> (thimbleberry)
<i>Fraxinus latifolia</i> (Oregon ash)	<i>Rubus spectabilis</i> (salmonberry)
<i>Lonicera involucrata</i> (black twinberry)	<i>Salix lucida</i> (Pacific willow)
<i>Malus fusca</i> (western crabapple)	<i>Salix sitchensis</i> (Sitka willow)
<i>Physocarpus capitatus</i> (Pacific ninebark)	<i>Sambucus racemosa</i> (red elderberry)
<i>Picea sitchensis</i> (Sitka spruce)	<i>Thuja plicata</i> (western red cedar)
<i>Populus balsamifera</i> (black cottonwood)	<i>Tsuga heterophylla</i> (western hemlock)

**Success Standard 2 –50% FACW or OBL Species Cover In The Emergent Zone**

The estimated aerial cover value for woody and herbaceous FACW and OBL species in the emergent area is 94% (CI<sub>99%</sub> = 89-99% cover). This value exceeds the 50% cover requirement. Fifteen FACW and OBL species occur in point-line data in the emergent zone, thus exceeding the three required by success criteria. These species are listed in Table 9.4. However, species diversity (evenness and richness) in this zone is low. *P. arundinacea* contributed an estimated 60% aerial cover (CI<sub>90%</sub> = 51-69% cover), and *Juncus effusus* (common rush) contributed 49% aerial cover (CI<sub>90%</sub> = 39-59% cover). Other FACW or OBL species individually contributed less than 3% aerial cover in this zone.

**Table 9.4 FACW and OBL Species in the Emergent Zone of SR 167 Mill Creek Stage 1A**

Latin Name	Common Name	Facultative Status
<i>Alopecurus geniculatus</i>	water foxtail	OBL
<i>Alopecurus pratensis</i>	meadow foxtail	FACW
<i>Eleocharis ovata</i>	ovate spikerush	OBL
<i>Eleocharis palustris</i>	common spikerush	OBL
<i>Epilobium ciliatum</i>	fringed willowherb	FACW-
<i>Fraxinus latifolia</i>	Oregon ash	FACW
<i>Juncus effusus</i>	common rush	FACW
<i>Juncus ensifolius</i>	swordleaf bulrush	FACW
<i>Phalaris arundinacea</i>	reed canarygrass	FACW
<i>Ranunculus repens</i>	creeping buttercup	FACW
<i>Salix</i> spp.	willows	FACW-OBL
<i>Scirpus microcarpus</i>	small-fruited bulrush	OBL
<i>Schoenoplectus tabernaemontani</i>	soft-stem bulrush	OBL
<i>Typha latifolia</i>	broadleaf cattail	OBL
<i>Veronica americana</i>	American speedwell	OBL

**Success Standard 3 – Habitat Structures**

An inventory of habitat structures confirmed that more than 10 habitat structures were present as prescribed by the mitigation plan. These included at least three types: large woody debris, brush piles, and at least two raptor perches.

Since monitoring began on this site, six bird species have been observed using the habitat structures. In 2002, Red-tailed Hawks (*Buteo jamaicensis*), Cedar Waxwings (*Bombycilla cedrorum*), Brown-headed Cowbirds (*Molothrus ater*) and swallows were observed using the raptor perches. In addition, Marsh Wrens (*Cistothorus palustris*),

American Goldfinches (*Carduelis tristis*) and American Robins (*Turdus migratorius*) were nesting in the scrub-shrub and wetland areas. These observations suggest that this site is providing habitat for numerous avian species.

Success Standard 4 – At Least 15% Aerial Cover of Woody Species in the Buffer; At Least 4 Native Species

Based on an ocular estimate, native trees and shrubs provide an estimated 40% aerial cover in the buffer zone. Field observations confirmed that all 11 native species planted in this area have survived well and contribute cover to the buffer. Woody vegetation in the buffer is developing notably faster than in the wetland.

## SR 202 Dry Creek, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 202 Dry Creek mitigation site in July 2002. To address third year success standards a total count of woody species and a qualitative vegetation survey were conducted in July 2002. Table 10.1 provides general site information and Table 10.2 shows this year's monitoring results.

**Table 10.1 General Site Information for the SR 202 Dry Creek Mitigation Site**

<b>Project Name</b>	SR 202 Vicinity SE 8 <sup>th</sup> St. to Vicinity 300 <sup>th</sup> Ave. SE Settlement Correction/Channelization and Junction 244 <sup>th</sup> Ave. NE Channelization and NE Ames Lake Road Vicinity
<b>Contract Number</b>	AW C 5302
<b>WDFW HPA Permit Number</b>	00-C5468-01
<b>Mitigation Location</b>	SR 202 at NE Ames Lake Road, King County
<b>Monitoring Period</b>	2000 to 2004
<b>Year of Monitoring</b>	3 of 5
<b>Area of Project Impact</b>	0.4 ha (1.0 ac)
<b>Type of Mitigation</b>	Stream Re-channelization

**Table 10.2 Monitoring and Management Summary from the SR 202 Dry Creek Mitigation Site**

<b>Performance Criteria</b>	<b>2002 Results</b>	<b>Management Activities</b>
1. $\geq 60\%$ survival of planted woody species, no fewer than 75% of the total number of species remaining	75% Total Count	
2. $\leq 15\%$ aerial cover of reed canarygrass in the planted zones	~1% Qualitative	Weed control

### Success Standards and Sampling Objectives

Third year success standards for the SR 202 Dry Creek mitigation site were excerpted from the *SR 202 Vicinity SE 8<sup>th</sup> St. to Vicinity 300<sup>th</sup> Ave. SE Settlement Correction/Channelization and Junction 244<sup>th</sup> Ave. NE Channelization and NE Ames Lake Road Vicinity Final Wetland Mitigation Plan* (Ossinger and Tolon 1997).

Objectives and Success Standards were prepared for a related wetland mitigation site, and have been slightly adapted for this re-channelization project. Appendix I provides the complete text of the success standards for this project.

#### Success Standard 1

Minimum of 60% survival of planted trees and shrubs, with no fewer than 75% of the total number of planted species remaining (2002).

### Success Standard 2

The aerial cover of *Phalaris arundinacea* (reed canarygrass) in the planted zones will not exceed 15% (2000-2004).

## **Methods**

To assess survival of woody species (Success Standard 1), a total count of woody species was conducted to evaluate survival. To evaluate aerial cover by *Phalaris arundinacea* (reed canarygrass) in the planted zones (Success Standard 2), a qualitative estimate was developed.

## **Results and Discussion**

The site continues to develop as intended. Planted material has become well established in both the upland and riparian areas. Planted and volunteer species currently provide about 35 to 40% cover, which is reasonable for a third year site, so replanting does not seem necessary (Figure 10.1). Native volunteer species include: *Alnus rubra* (red alder) and *Rubus spectabilis* (salmonberry).



**Figure 10.1** SR 202 Dry Creek (July 2002).

### Success Standard 1 –60% Survival; At Least 75% of Planted Species Remaining

Ten woody species were planted, and all were present in 2002. Based on a total count conducted in 2000, survival in the third year was calculated to be 75% (Table 10.3).

### Success Standard 2 – Less Than 15% Cover by *Phalaris arundinacea*

Based on an ocular estimate, *P. arundinacea* provides about 1% cover on the entire site. Small colonies are scattered on the east bank near the upstream end of Ames Lake Road with an additional small clump near the center of the SR 202 roadside.

Other invasive species observed on the site include: *Cirsium vulgare* (bull thistle) along the road, *Rubus armeniacus* (Himalayan blackberry) scattered across the site, and along the first curve of west bank, a few scattered *Cirsium arvense* (Canada thistle). *Geranium robertianum* (stinky Bob) is prevalent in the streambed and has colonized small areas of the upland. These invasive species provided low cover and do not appear to be restricting development of the intended vegetative communities.

**Table 10.3 Survival at the SR 202 Dry Creek Mitigation Site**

Scientific Name	Common Name	Counted in 2000	Counted in 2002	Percent Survival
<i>Acer macrophyllum</i>	bigleaf maple	48	32	67%
<i>Alnus rubra</i>	red alder	4	4	100%
<i>Cornus sericea</i>	redosier dogwood	28	27	96%
<i>Fraxinus latifolia</i>	Oregon ash	6	6	100%
<i>Pseudotsuga menziesii</i>	Douglas-fir	52	47	90%
<i>Rubus spectabilis</i>	salmonberry	33	26	79%
<i>Salix</i> sp.	willows	53	17	32%
<i>Sambucus racemosa</i>	red elderberry	60	22	37%
<i>Symphoricarpos albus</i>	common snowberry	210	204	97%
<i>Thuja plicata</i>	western red cedar	68	61	90%
Unknown Dead		65	13	--
<b>Total Observed</b>		<b>627</b>	<b>468</b>	<b>75%</b>

#### Other Observations

Based on qualitative estimates, *Thuja plicata* (western red cedar), *Acer macrophyllum*, *Pseudotsuga menziesii* (Douglas-fir), and *Sambucus racemosa* (red elderberry) average greater than 2 m in height in the upland areas. Riparian woody species were dense along most of the stream edge, and average 2.5 to 3 m in height.

### **Management Activities**

Table 10.4 provides a summary of management activities at this site.

**Table 10.4 Summary of Management Activities SR 202 Dry Creek Mitigation Site**

Date	Description of Management Activity
Spring/Summer 2002	Weed control was conducted periodically through June
Fall 2001	Herbicide application to invasive species.
Summer 2001	Monthly hand watering of planted woody material, and hand weeding around planting wells.
Summer 2000	Hand watered planted woody material, and hand weeded around planting wells. <i>Buddleia</i> sp. (butterfly bushes) were removed from streambed.

## SR 203 Harris Creek, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 203 Harris Creek mitigation site during July 2002. Monitoring data were obtained to compare to third year success standards and permit requirements. Activities included vegetation surveys of the herbaceous and woody wetland plant communities and a functional assessment. Table 11.1 provides general site information for SR 203 Harris Creek, and Table 11.2 summarizes this year's monitoring results.

**Table 11.1 General Information for the SR 203 Harris Creek Mitigation Site.**

<b>Project Name</b>	SR 203 Vicinity NE 77 <sup>th</sup>
<b>Contract Number</b>	AT MS4073
<b>USACE Permit</b>	95-4-01134 (NWP 23)
<b>WSDOF Hydraulic Project Approval</b>	00-C5769-02
<b>Mitigation Location</b>	SR 203, Vicinity NE 77 <sup>th</sup> & Stillwater Hill Rd., King Co.
<b>Township/Range/Section (impact)</b>	T.25N/R.7E/S.4, 9, & 10
<b>Monitoring Period</b>	2000 to 2004
<b>Year of Monitoring</b>	3 of 5
<b>Area of Project Impact<sup>37</sup></b>	0.78 ha (1.93 ac)
<b>Type of Mitigation</b>	Wetland Enhancement
<b>Area of Mitigation</b>	1.83 ha (4.52 ac)

**Table 11.2 Monitoring and Management Summary SR 203 Harris Creek Mitigation Site.**

Performance Criteria	2002 Results <sup>38</sup>	Management Activities
<b>Success Standards</b>		
1. $\geq 60\%$ survival of planted individuals, with $\geq 75\%$ of planted species remaining	<ul style="list-style-type: none"> <li>Woody: 92% (<math>CI_{95\%} = 89-96\%</math> survival)</li> <li>Herbaceous: adequate (qualitative)</li> <li>94% planted species remain (17 of 18 spp.)</li> </ul>	2002, additional woody plants installed
2. $\leq 15\%$ aerial cover of reed canarygrass	19% ( $CI_{80\%} = 16-23\%$ cover)	Weed control
<b>Permit Requirements (WSDOF HPA #00-C5769-02)</b>		
1. $\geq 80\%$ survival of planted vegetation	Woody: 92% ( $CI_{95\%} = 89-96\%$ survival) Herbaceous: adequate (qualitative)	2002, additional woody plants installed
2. Functional assessment to determine if goals are met	Increasing capacity to provide the intended wetland functions	

<sup>37</sup> SR 203 Harris Creek provides partial compensation for impacts from the SR 203 Vicinity 77<sup>th</sup> project. The SR 203 Morris Creek site provides the remaining compensation for the project.

<sup>38</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 92% ( $CI_{95\%} = 89-96\%$  survival) means we are 95% confident that the true aerial cover value is between 89% and 96%.

## **Success Standards, Permit Requirements, and Sampling Objectives**

Third year success standards and a permit requirement for the SR 203 Harris Creek mitigation site were excerpted from the *SR 203 Vicinity NE 77<sup>th</sup> Final Wetland Mitigation Plan* (Ossinger 1996) and the Washington Department of Fisheries Hydraulic Project Approval #00-C5769-02, issued February 12, 1997. Sampling objectives follow the success standards and permit requirement where appropriate. Appendix J provides the complete text of the success standards and contingency plans for this project.

### Success Standard 1

Minimum 60% survival of planted individuals, with no fewer than 75% of the total number of planted species remaining (i.e, if 20 species are planted, at least 15 of those species will be present onsite after three years) (2002).

### Permit Requirement 1

Monitoring, maintenance and replacement of the vegetation shall be conducted as necessary to assure 80 percent survival after three years (2002).

#### Sampling Objective (Success Standard 1 and Permit Requirement 1)

To be 80% confident true survival of the planted woody species is within 20% of the estimated value.

### Success Standard 2

The aerial cover of *Phalaris arundinacea* (reed canarygrass) in both enhancement areas will not exceed 15% (2002).

#### Sampling Objective 2

To be 80% confident the true aerial cover of *P. arundinacea* is within 20% of the estimated value.

### Permit Requirement 2

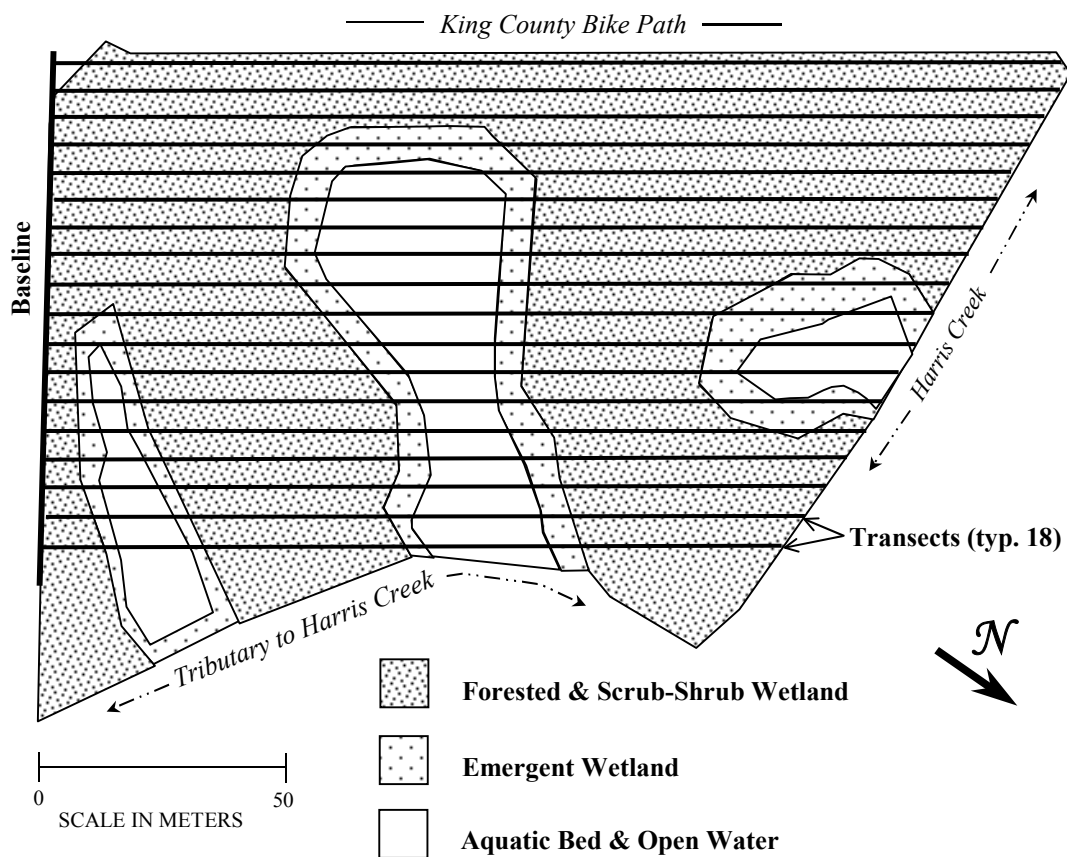
An analysis of how the mitigation site is functioning compared to the preproject goals shall be conducted after three years (2002).

## **Methods**

Plant survival and *P. arundinacea* abundance were quantitatively sampled. A baseline was established along the southeast edge of the site (Figure 11.1). Eighteen temporary transects were located perpendicular to this baseline using a systematic random method. Open water areas were not sampled.

Assessment of Success Standard 1 consisted of three components: 1) woody plant survival; 2) herbaceous plant survival; and, 3) retention of planted species. These are discussed in more detail below. Permit Requirement 1 was addressed concomitantly with Success Standard 1 due to similarities between the two.





**Figure 11.1 SR 203 Harris Creek Mitigation Site Sampling Design (2002).**

Woody plant survival was evaluated by collecting data from 18 quadrat sample units (1 x 140 m). Live and dead plants were enumerated within each quadrat. All planted and naturally recruited native individuals were included. Empty planting wells were included as 1 dead individual each. Survival was calculated as the number of live individuals divided by the total number of live and dead individuals.

Herbaceous plant survival was assessed qualitatively. A quantitative assessment could not be performed because feasible and reliable methods do not exist for evaluating third-year survival of high numbers of herbaceous plants.

Retention of planted species (i.e., how many of the planted species are still present) was evaluated by enumerating all planted species identified while monitoring. This value was then divided by the number of species planted to determine the percentage of planted species remaining. Naturally recruited species were not included.

To address Success Standard 2, *P. arundinacea* data were collected using the point-line method. Eighteen 140-m point-line sample units were randomly located along sampling transects. Data were obtained at 560 point locations on each sample unit.

Sample size analysis was used to confirm that collected data were sufficient to satisfy sampling objectives and desired level of statistical confidence. The following sample size equation was used to perform this analysis:

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>39</sup>  
n = unadjusted sample size

A functions assessment was completed in January of 2002 using the Wetland Functions Characterization Tool for Linear Projects (WSDOT, 2000).

For more details of monitoring techniques, see the Methods section of the Introduction and/or Glossary.

## Results and Discussion

### Success Standard 1 – 60% Plant Survival and 75% Retention of Planted Species

#### Permit Requirement 1 – 80% Plant Survival

Woody plant survival was estimated at 92% (CI<sub>95%</sub> = 89-96% survival), which satisfies the survival standard and permit requirement for year three. It should be noted, however, that this estimate might be inflated due to the uncertainty in detecting mortality several years after planting. It is not known how much this may have influenced the survival estimate. Qualitative observations indicate that woody plant communities are well established, healthy and thriving throughout the site. This suggests that the intent of Success Standard 1 (establishing a variety of native trees, shrubs, and herbaceous species) has been met.

Based on the planting plan, all the woody species that were installed remain on site, and 5 additional native species that were not planted are present: *Amelanchier alnifolia* (Saskatoon service-berry), *Physocarpus capitatus* (Pacific ninebark), *Sambucus racemosa* (red elderberry), *Spiraea douglasii* (hardhack), and *Symphoricarpos albus* (common snowberry).

Qualitative observations indicate that emergent zones demonstrate high aerial cover with diverse native wetland plant communities. These communities appear to meet the intent of Success Standard 1 - to “establish a variety of native trees, shrubs, and herbaceous species...” (Ossinger 1996). Native wetland herbaceous vegetation appears dense and provides substantial cover in the areas intended (Table 11.3; Figure 11.2). In addition, current species richness exceeds the number of species on the planting plan. This is due in part to substantial natural recruitment of non-planted native species. The result is that native herbaceous vegetation appears sufficiently established to satisfy the intent of Success Standard 1.

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<sup>39</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

**Table 11.3 Partial List of Herbaceous Plant Species Observed Within the Emergent and Aquatic Bed Zones of the SR 203 Harris Creek Wetland Mitigation Site.<sup>40</sup>**

Scientific Name	Common Name	Indicator Status	Nativity
<i>Alopecurus geniculatus</i>	water foxtail	OBL	nonnative
<i>Carex stipata</i>	owlfruit sedge	OBL	native
<i>Eleocharis ovata</i>	ovate spikerush	OBL	native
<i>Glyceria</i> sp.	mannagrasses		
<i>Juncus effusus</i>	common rush	FACW	native
<i>Polygonum</i> sp.	knotweeds or smartweeds		
<i>Potamogeton</i> sp.	pondweeds		
<i>Schoenoplectus tabernaemontanii</i>	soft-stem bulrush	OBL	native
<i>Scirpus cyperinus</i> and/or <i>S. microcarpus</i> <sup>41</sup>	woolgrass panicked bulrush	OBL OBL	native native
<i>Sparganium angustifolium</i>	narrowleaf bur-reed	OBL	native
<i>Typha latifolia</i>	broadleaf cattail	OBL	native



**Figure 11.2 Photograph of Herbaceous Plant Community at South Pond of the SR 203 Harris Creek Mitigation Site (July 2002).<sup>42</sup>**

Seventeen of the 18 woody and herbaceous species planted were observed on-site. Thus, 94% of planted species have been retained. This meets the minimum of 75% required by Success Standard 1.

<sup>40</sup> Species listed appeared to exist in greater abundance than those not listed.

<sup>41</sup> Specimens observed on site were too immature to identify to species. Due to similarities in appearance, at least one and perhaps both of these species were present.

<sup>42</sup> North and center ponds showed similar development.

In general, native trees, shrubs, and herbaceous vegetation appear to be well established, healthy and flourishing throughout the site. With continued development, the site appears likely to meet the fifth year standard and overall objective for establishment of native vegetation (see Appendix J).

#### Success Standard 2 – Less Than 15% Aerial Cover of *P. arundinacea*

Aerial cover of *P. arundinacea* was estimated at 19% (CI<sub>80%</sub> = 16-23% cover). This does not satisfy the 15% aerial cover standard despite ongoing control efforts (see the Management Activities section below for a timeline of control measures that have been implemented).

Invasive species other than *P. arundinacea* were present at minimal levels. The estimated aerial cover for all invasive species combined was 20% (CI<sub>80%</sub> = 16-23% cover). This is nearly identical to the estimate for *P. arundinacea* alone. The abundance of other invasive species may thus be considered negligible. Other invasive species observed on site include: *Rubus armeniacus* (Himalayan blackberry), *Rubus laciniatus* (cutleaf blackberry), *Cirsium vulgare* (bull thistle), *Geranium robertianum* (stinky Bob), and *Iris pseudacorus* (paleyellow iris).

Results of the functions assessment indicate the site appears to be developing an increasing capacity to provide the intended wetland functions. Enhancement of the existing wet pasture and farmland through excavation of side channel habitat along Harris Creek has added flood storage capacity, stream base flow support, and improved habitat for salmonids. Re-vegetation with trees and shrubs is adding structural diversity, which in turn should lead to increased wildlife use and food chain support.

### **Management Activities**

Management activities implemented since the site was initially planted have included invasive species control and installation of additional plants. These are summarized in Table 11.4.

**Table 11.4 Summary of Management Activities Performed at the SR 203 Harris Creek Wetland Mitigation Site.**

<b>Date</b>	<b>Description of management activity</b>
2002, fall	Invasive species control – herbicide application <sup>43</sup>
2002, winter	Additional woody plants installed.
2001, summer	Invasive species control – herbicide application.
2001, winter	Additional woody plants installed.
2000, summer	Invasive species control – mechanical (pulling, cutting & trampling).

<sup>43</sup> This activity was performed *after* monitoring data summarized in this report were collected.

## SR 203 Morris Creek, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 203 Morris Creek mitigation site during July 2002. Monitoring data were obtained to compare to third year success standards and permit requirements. Activities included vegetation surveys of the herbaceous and woody wetland plant communities and a functional assessment. Table 12.1 provides general site information for SR 203 Morris Creek, and Table 12.2 summarizes this year's monitoring results.

**Table 12.1 General Site Information for the SR 203 Morris Creek Mitigation Site**

<b>Project Name</b>	SR 203 Vicinity NE 77 <sup>th</sup>
<b>Contract Number</b>	AT MS4073
<b>USACE Permit Number</b>	95-4-01134 (NWP 23)
<b>WSDOF HPA Permit Number</b>	00-C5769-02
<b>Mitigation Location</b>	SR 203, Vicinity NE 77 <sup>th</sup> and Stillwater Hill Road, King County
<b>Township/Range/Section (impact)</b>	T.25N/R.7E/S.4, 9, & 10
<b>Monitoring Period</b>	2000 to 2004
<b>Year of Monitoring</b>	3 of 5
<b>Area of Project Impact<sup>44</sup></b>	0.78 ha (1.93 ac)
<b>Type of Mitigation</b>	Wetland Enhancement
<b>Area of Mitigation</b>	1.48 ha (3.66 ac)

**Table 12.2 Monitoring and Management Summary SR 203 Morris Creek Mitigation Site**

<b>Performance Criteria</b>	<b>2002 Results<sup>45</sup></b>	<b>Management Activities</b>
<b>Success Standards</b>		
1. ≥ 60% survival of planted species, with ≥ 75% of planted species remaining	<ul style="list-style-type: none"> <li>Woody: 95% (CI<sub>90%</sub> = 90-100% survival)</li> <li>Herbaceous: adequate (qualitative)</li> <li>94% planted species remain (16 of 17 spp.)</li> </ul>	2001, replaced dead woody plantings
2. < 15% aerial cover of reed canarygrass	18% (CI <sub>80%</sub> = 15-21% cover)	Weed control
<b>Permit Requirements (WSDOF HPA #00-C5769-02)</b>		
1. ≥ 80% survival of planted species	Woody: 95% (CI <sub>90%</sub> = 90-100% survival) Herbaceous: adequate (qualitative)	2001, replaced dead woody plantings
2. Functional assessment to determine if goals are met	Increasing capacity to provide the intended wetland functions	

<sup>44</sup> SR 203 Morris Creek provides partial compensation for impacts from the SR 203 Vicinity 77<sup>th</sup> project. The SR 203 Harris Creek site provides the remaining compensation for the project.

<sup>45</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 95% (CI<sub>90%</sub> = 90-100% survival) means we are 90% confident that the true aerial cover value is between 90% and 100%.

## **Success Standards, Permit Requirements, and Sampling Objectives**

Third year success standards and a permit requirement for the SR 203 Morris Creek mitigation site were excerpted from the *SR 203 Vicinity NE 77<sup>th</sup> Final Wetland Mitigation Plan* (Ossinger 1996) and the Washington Department of Fisheries Hydraulic Project Approval #00-C5769-02, issued February 12, 1997. Sampling objectives follow the success standards and permit requirements where appropriate. Appendix J provides the complete text of the success standards and permit requirements for this project.

### Success Standard 1

Minimum 60% survival of planted individuals, with no fewer than 75% of the total number of planted species remaining (i.e, if 20 species are planted, at least 15 of those species will be present onsite after three years) (2002).

### Permit Requirement 1

Monitoring, maintenance and replacement of the vegetation shall be conducted as necessary to assure 80% survival after three years (2002).

#### Sampling Objective (Success Standard 1 and Permit Requirement 1)

To be 80% confident true survival of the planted woody species is within 20% of the estimated value.

### Success Standard 2

The aerial cover of *Phalaris arundinacea* (reed canarygrass) in both enhancement areas will not exceed 15% (2002).

#### Sampling Objective 2

To be 80% confident the true aerial cover of *P. arundinacea* is within 20% of the estimated value.

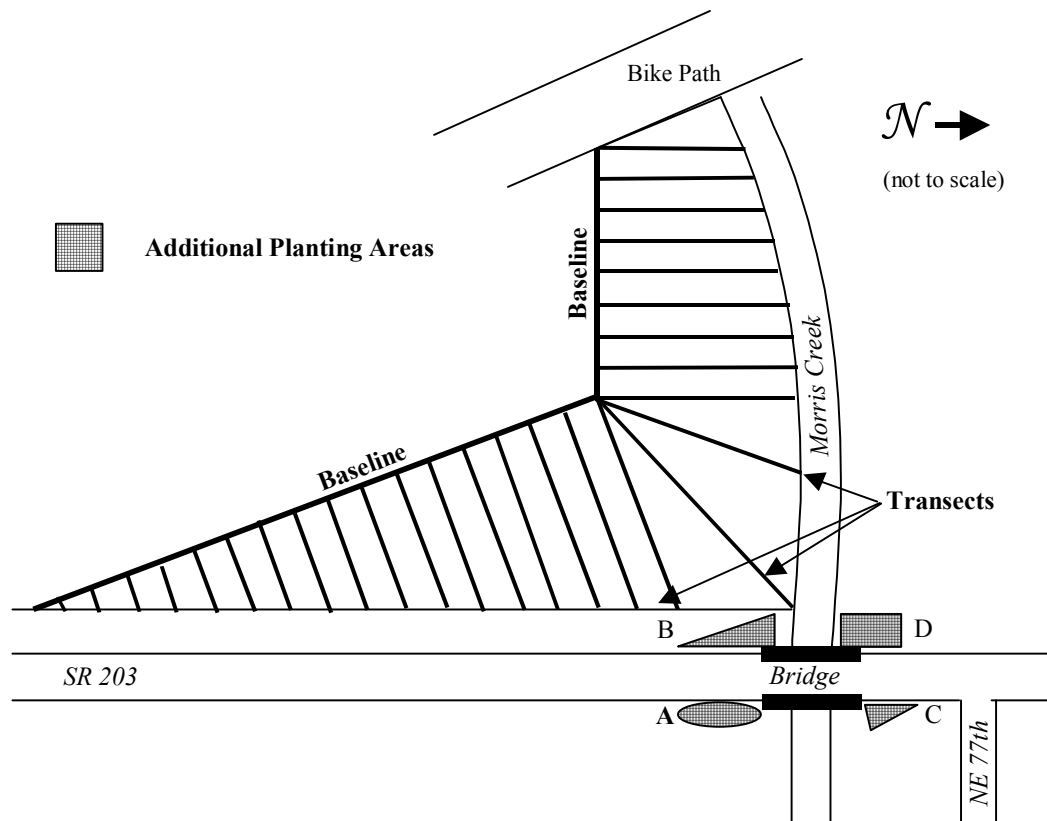
### Permit Requirement 2

An analysis of how the mitigation site is functioning compared to the preproject goals shall be conducted after three years (2002).

## **Methods**

To evaluate both woody survival and herbaceous cover requirements, 42 temporary transects were placed on the site. Most transects were positioned perpendicular to baselines along fences bordering the southwest and south sides of the site, using the systematic random sampling method (Figure 12.1). From the corner where the baselines meet, 2 additional transects were randomly placed within the unsampled area in the southeast corner of the site.

Success Standard 1 and Permit Requirement 1 both address survival of planted vegetation. The more stringent permit requirement was considered the criterion for



**Figure 12.1 SR 203 Morris Creek Mitigation Site Sampling Design (2002)**

success. To address the survival of planted woody species, data were collected on 54 quadrat sample units (1 x 20 m) randomly placed along sampling transects. Planted trees and shrubs observed within each quadrat sample unit were identified to species and recorded as alive or dead. Qualitative observations were also considered in assessing woody survival.

Herbaceous plant survival was assessed qualitatively including the creation of a plant list to determine if a variety of herbaceous species was established. Success Standard 1 also addressed the retention of planted species. Retention was evaluated by comparing the list of planted woody and herbaceous species to those observed during monitoring.

To address Success Standard 2, *P. arundinacea* cover data were collected using the point-line method across the entire site. Eighty-nine point-line sample units 20 m in length were randomly located along sampling transects. Data were obtained at 80 point locations on each sample unit.

Sample size analysis confirmed that sufficient sampling had been completed based on the sampling objective and the desired level of statistical confidence. The following sample size equation was used to perform this analysis on the collected data.



$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>46</sup>  
n = unadjusted sample size

The 4 planting areas adjacent to the SR 203 bridge over Morris Creek (Additional Planting Areas A, B, C, and D) were assessed separately. A total count was conducted to determine survival of woody plantings for Success Standard 1. Each planted tree and shrub observed in all areas was identified to species and recorded as alive or dead. Herbaceous species were not planted in these areas and thus survival and retention of herbaceous plantings was not assessed. Retention of woody species was evaluated by comparing the list of planted species to those observed during monitoring. To address Success Standard 2 in the additional planting areas, ocular estimates of *P. arundinacea* aerial cover were generated.

A functions assessment was completed in January of 2002 using the Wetland Functions Characterization Tool for Linear Projects (WSDOT 2000).

For more details of monitoring techniques, see the Methods section of the Introduction and/or Glossary.

## Results and Discussion

### Success Standard 1– At Least 60% Plant Survival, and At Least 75% Retention of Planted Species

#### Permit Requirement 1– At Least 80% Survival

The mean survival estimate of planted woody species on the mitigation site was 95% (CI<sub>90%</sub> = 90-100% survival), which appears to satisfy both Success Standard 1 and Permit Requirement 1 for year three (Figure 12.2).

However, plant mortality and natural recruitment can confound results if survival is monitored long after initial



**Figure 12.2 SR 203 Morris Creek (July 2002).**

<sup>46</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.



plant establishment. Therefore survival values may be inflated due to the inability to detect dead plantings in the third year. Qualitative observations indicated that the woody plantings appear healthy. The quantitative and qualitative results indicate that woody planted species are sufficiently diverse to satisfy the intent of Success Standard 1, to “establish a variety of native trees, shrubs, and herbaceous species” (Ossinger 1996).

Qualitative assessment of herbaceous species survival indicated that several native species, including naturally-colonizing wetland species, contributed to a diverse native plant community (Table 12.3). Given the objective for Success Standard 1, native herbaceous vegetation appears sufficiently diverse to meet the intent of the survival threshold.

**Table 12.3 SR 203 Morris Creek: Native, Naturally-colonizing, Herbaceous, Wetland Species**

Scientific Name	Common Name	Indicator Status
<i>Alisma triviale</i>	northern water plantain	OBL
<i>Eleocharis ovata</i>	ovate spikerush	OBL
<i>Epilobium ciliatum</i>	fringed willowherb	FACW-
<i>Equisetum</i> sp.	Horsetails	FAC and wetter
<i>Festuca rubra</i>	red fescue	FAC+
<i>Impatiens noli-tangere</i>	western touch-me-not	FACW
<i>Juncus effusus</i>	common rush	FACW
<i>Leersia oryzoides</i>	rice cutgrass	OBL
<i>Ludwigia palustris</i>	marsh seedbox	OBL
<i>Lysichiton americanus</i>	American skunkcabbage	OBL
<i>Sparganium angustifolium</i>	narrowleaf bur-reed	OBL
<i>Typha latifolia</i>	broadleaf cattail	OBL

Sixteen (94%) of the 17 woody and herbaceous species planted at the site were observed during monitoring, thus meeting the 75% species retention threshold of Success Standard 1. Although not included in survival estimates, native species such as *Populus balsamifera* (black cottonwood), *Alnus rubra* (red alder), *Juncus effusus* (common rush), and *Leersia oryzoides* (rice cutgrass) were colonizing the site.

#### Success Standard 2 – Less Than 15% Aerial Cover of *P. arundinacea*

The mean aerial cover estimate of *P. arundinacea* on the site was 18% (CI<sub>80%</sub> = 15-21% cover). Despite previous weed control efforts, this value exceeds the 15% threshold specified in Success Standard 2. Other invasive species on site included *Cirsium arvense* (Canada thistle), *Cirsium vulgare* (bull thistle), *Phragmites australis* (common reed), *Rubus armeniacus* (Himalayan blackberry), and *Rubus laciniatus* (cutleaf blackberry). Each of these species provided less than 5% cover, and do not appear to pose a threat to site development.

Results for the 4 additional planting areas adjacent to the SR 203 bridge over Morris Creek were slightly different than those of the rest of the site. For Success Standard 1, the survival of trees and shrubs was 100% in Planting Area A, B, C, and D, exceeding the threshold. All of the woody species planted in the additional planting areas were present during monitoring, meeting the species retention threshold. Ocular estimates for aerial

cover of *P. arundinacea* (Success Standard 2) were very low (less than 5%) in areas A, B, and D, but about 40% in area C. With the exception of *P. arundinacea* in Planting Area C, the 4 additional planting areas appear to meet the Success Standards and Permit Requirement, and are well established.

Results of the functions assessment indicate the site appears to be developing an increasing capacity to provide the intended wetland functions. Enhancement of the existing wet pasture and farmland through re-vegetation with trees and shrubs is adding structural diversity, which in turn should lead to increased wildlife use and food chain support.

## Management Activities

Table 12.4 provides a summary of management activities at this site.

**Table 12.4 Summary of Management Activities at the SR 203 Morris Creek Mitigation Site.**

Date	Description of Management Activity
2002, September <sup>47</sup>	Invasive species control – herbicide application
2002, winter	Additional woody plants installed.
2001, July	Invasive species control – herbicide application.
2001, winter	Additional woody plants installed.
2000, summer	Invasive species control – mechanical (pulling, cutting & trampling).

<sup>47</sup> This activity was performed *after* monitoring data summarized in this report were collected.

## SR 203 Stillwater Hill Road, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 203 Stillwater Hill Road mitigation site in September 2002. Monitoring data were obtained to compare to first year success standards. Activities included a total count of planted trees and shrubs. Table 13.1 provides general site information and Table 13.2 shows this year's monitoring results.

**Table 13.1 General Site Information for the SR 203 Stillwater Hill Road Mitigation Site**

<b>Site Name</b>	SR 203 NE 77 <sup>th</sup> /NE Stillwater Hill Road and Fay Road Project
<b>Contract Number</b>	AT MS 4073
<b>Location</b>	SR 203 between NE Stillwater Hill Road and Fay Road, King Co.
<b>Monitoring Period</b>	2002 to 2004
<b>Year of Monitoring</b>	1 of 3
<b>Area of Project Impact</b>	0.124 ha (0.307 ac)
<b>Type of Mitigation</b>	Enhancement
<b>Area of Mitigation</b>	0.249 ha (0.614 ac)

**Table 13.2 Monitoring and Management Summary SR 203 Stillwater Hill Road Mitigation Site**

<b>Performance Criteria</b>	<b>2002 Results</b>	<b>Management Activities</b>
1. $\geq 80\%$ survival of planted woody species	97% (total count)	Contractor plans to replace plants that have died in February 2003

### Success Standards and Sampling Objectives

First year success standards for the SR 203 Stillwater Hill Road mitigation site were excerpted from the *SR 203 Vicinity NE 77th Supplement #3 to Final Wetland Mitigation Plan* (WSDOT 2001). Appendix K provides the complete text of the success standards for this project.

#### Success Standard

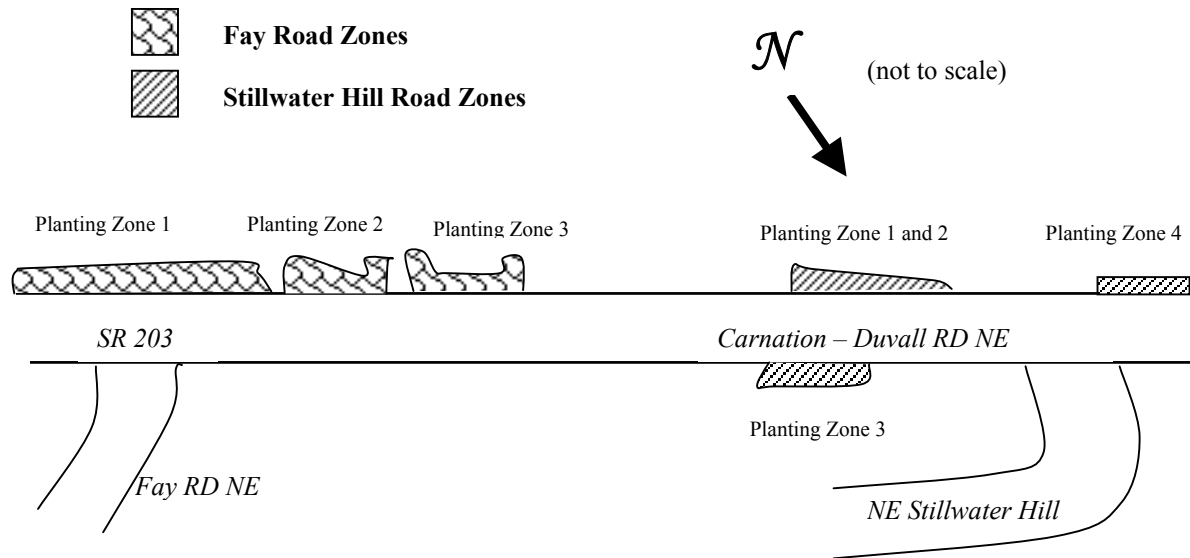
Minimum 80% survival of planted species (2002).

#### Contingency Plan

In the first year of plant establishment, all dead or unhealthy plants will be replaced (2002).

## Methods

To address survival of the planted species (Success Standard 1 and Contingency), plantings in each zone (Figure 13.1) were identified, counted and recorded as alive, stressed, or dead. Empty planting wells were counted and recorded as dead unknowns.



**Figure 13.1** SR 203 Stillwater Hill Road Mitigation Site (2002)

## Results and Discussion

### Success Standard –80% Survival

In 2002, survival of planted woody species was calculated to be 97%, thus exceeding the first year requirement. Survival in each individual planting zone ranged from 95 to 100%. Figure 13.2 shows part of Planting Zones 1 and 2 near Stillwater Hill Road. Table 13.3 shows survival for the whole site. Each of the 5 planted species were present on site.



**Figure 13.2** SR 203 Stillwater Hill Mitigation Site (September 2002)

**Table 13.3 Survival of Planted Woody Species SR 203 Stillwater Hill Road Mitigation Site**

Plant Name	Alive	Stressed	Dead	Total	Survival
Fay Road					
<i>Acer circinatum</i> (vine maple)	66	3	1	70	99%
<i>Holodiscus discolor</i> (oceanspray)	140	27	3	170	98%
<i>Rubus spectabilis</i> (salmonberry)	152	11	0	163	100%
<i>Sambucus racemosa</i> (red elderberry)	135	11	2	148	99%
<i>Symphoricarpos albus</i> (common snowberry)	181	4	1	186	99%
Unknown	0	0	21	21	--
<b>Total</b>	<b>730</b>		<b>28</b>	<b>758</b>	<b>96%</b>
Stillwater Hill Road					
<i>Acer circinatum</i> (vine maple)	14	0	0	14	100%
<i>Holodiscus discolor</i> (oceanspray)	22	3	1	26	96%
<i>Rubus spectabilis</i> (salmonberry)	89	5	0	94	100%
<i>Sambucus racemosa</i> (red elderberry)	20	0	0	20	100%
<i>Symphoricarpos albus</i> (common snowberry)	114	9	1	124	99%
Unknown	0	0	4	4	--
<b>Total</b>	<b>276</b>		<b>6</b>	<b>282</b>	<b>98%</b>
<b>Site Total</b>	<b>1006</b>		<b>34</b>	<b>1040</b>	<b>97%</b>

Based on ocular estimates, aerial cover of invasive species across the site is less than 1%. However, *Rubus armeniacus* (Himalayan blackberry) is starting to encroach at the edge of Stillwater Hill Road Planting Zones 1, 2, and 4. In the Fay Road area, *Cytisus scoparius* (Scotch broom), *R. armeniacus*, and *Convolvulus arvensis* (field bindweed) are present in Planting Zone 3. These species may pose a threat to future site development if not controlled.

### Management Activities

The contractor plans to replace dead woody plantings in February 2003.

## SR 516 Bartol, King County

The following report summarizes monitoring activities completed by the Washington State Department of Transportation Wetland Monitoring Program at the SR 516 Bartol mitigation site in July 2002. Monitoring data were obtained to compare to fifth year success standards and the contingency plan. Activities included vegetation and bird surveys, and a qualitative evaluation of overall site development. Table 14.1 provides general site information for the SR 516 Bartol mitigation site, and Table 14.2 summarizes this year's monitoring results.

**Table 14.1 General Site Information for the SR 516 Bartol Mitigation Site**

<b>Project Name</b>	SR 18 312 <sup>th</sup> Way to Covington Way	
<b>Contract Number</b>	GD MS4091	
<b>USACE Permit Number</b>	95-4-00203	
<b>Mitigation Location</b>	North of SR 516, west of Big Soos Creek, King County	
<b>Township/Range/Section (impact)</b>	T.21N/R.6E/S.3 & 10 and T.22N/R.6E/S.35	
<b>Monitoring Period</b>	1998 to 2002	
<b>Year of Monitoring</b>	5 of 5	
<b>Area of Project Impact</b> <sup>48</sup>	Wetland - 0.71 ha (1.77ac)	Buffer - 0.82 ha (2.05 ac)
<b>Type of Mitigation</b>	Wetland Creation	Wetland Enhancement
<b>Area of Mitigation</b>	0.44 ha (1.1 ac)	0.75 ha (1.88 ac)
<b>Type of Mitigation</b>	Wetland Buffer Creation	
<b>Area of Mitigation</b>	0.23 ha (0.58 ac)	

**Table 14.2 Monitoring Summary from the SR 516 Bartol Mitigation Site**

Performance Criteria	2002 Results <sup>49</sup>
<b>Success Standards</b>	
1. ≥ 80% aerial cover of woody wetland vegetation in the wetland	Wetland B: 31% (CI <sub>80%</sub> = 22-39% cover) Wetland C: 52% (CI <sub>80%</sub> = 43-61% cover)
2. ≥ 75% aerial cover of woody vegetation in the buffer area	Buffer A: 13% (CI <sub>80%</sub> = 8-18% cover)
3. ≥ 80% aerial cover of woody plants on the site	Buffer A: 13% (CI <sub>80%</sub> = 8-18% cover) Wetland B: 39% (CI <sub>80%</sub> = 31-46% cover) Wetland C: 51% (CI <sub>80%</sub> = 41-61% cover)
4. Observable height differences between shrubs and trees	Significant difference ( $P < 0.01$ )
<b>Contingency Plan</b>	
5. < 10% aerial cover of invasive species	Buffer A: 25% (CI <sub>80%</sub> = 21-29% cover) Wetland B: 9% (CI <sub>80%</sub> = 6-12% cover) Wetland C: 54% (CI <sub>80%</sub> = 44-64% cover)

<sup>48</sup> SR 516 Bartol provides partial compensation for impacts from the SR 18 SE 304<sup>th</sup> Street to Covington Way project. The SR 18 Kendal mitigation site provides the remaining compensation for the project.

<sup>49</sup> Estimated values are presented with their corresponding statistical confidence interval. For example, 31% (CI<sub>80%</sub> = 22-39% cover) means we are 80% confident that the true aerial cover value is between 22% and 39%.

## **Success Standards, Contingency, and Sampling Objectives**

Fifth year success standards and the contingency measure for the SR 516 Bartol mitigation site were excerpted from the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1994). Sampling objectives follow the success standards and contingency measure where appropriate. Appendix F provides the complete text of the success standards and contingency plan for this project.

### Success Standard 1

The wetland should have 80% areal (*sic*) cover of forested and scrub-shrub wetland vegetation (2002).

#### Sampling Objective 1

To be 80% confident the true aerial cover of woody wetland vegetation (FAC and wetter) in the wetland is within 20% of the estimated value.

### Success Standard 2

Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 75% or greater cover (2002).

#### Sampling Objective 2

To be 80% confident the true aerial cover of native woody species in the upland and riparian forested buffer is within 20% of the estimated value.

### Success Standard 3

The mitigation site should have 80% areal (*sic*) cover of trees and shrubs (2002).

#### Sampling Objective 3

To be 80% confident the true aerial cover of woody species on the entire site is within 20% of the estimated value.

### Success Standard 4

Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed (2002).

#### Sampling Objective 4

To detect a significant difference ( $\alpha = 0.05$ ) between the heights of shrubs and trees.

### Contingency Plan 5

A weed control plan will be implemented if more than 10% of the wetland is invaded by invasive exotic species (2002).

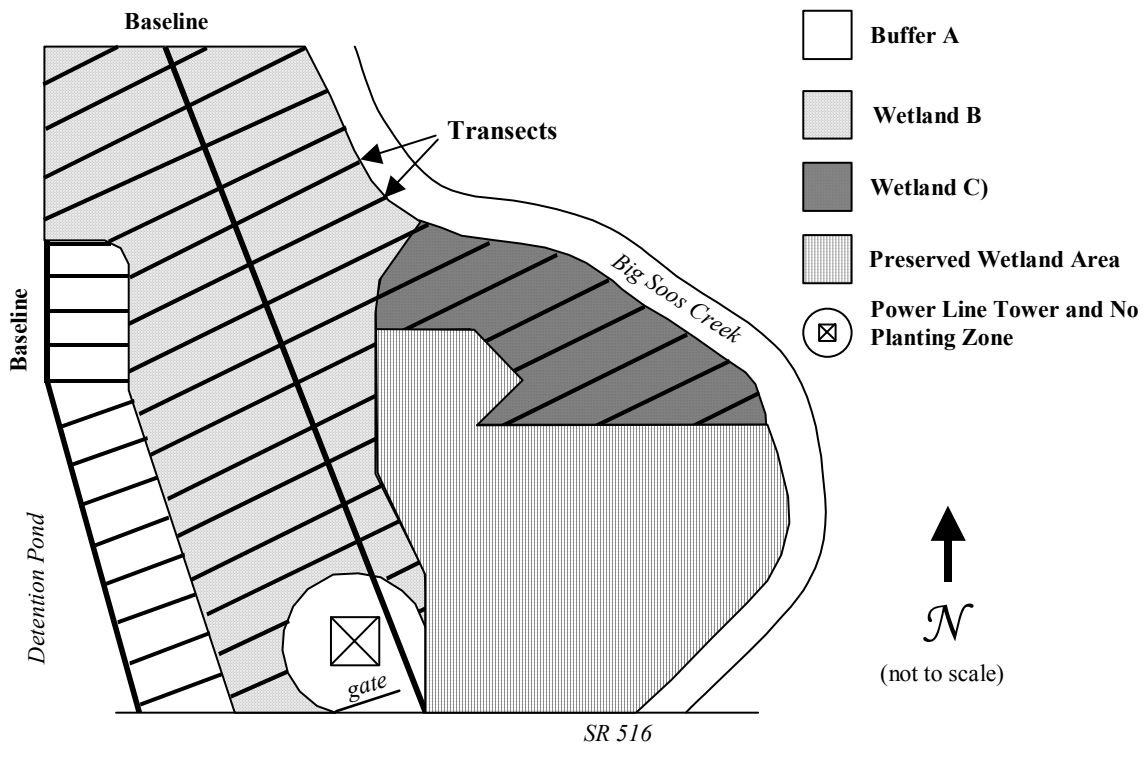
### Contingency Sampling Objective

To be 80% confident the true aerial cover for invasive exotic species on the entire site is within 20% of the estimated aerial cover value.

### **Methods**

To evaluate cover of woody vegetation and invasive species, 3 temporary sampling areas were placed on the site: buffer A, wetland B, and wetland C. Baselines were established along the southwest and west edges of upland buffer A. A baseline for wetlands B and C was created through the center of the wetland portion of the site. Transects were placed perpendicular to the baselines using the systematic random sampling method (Figure 14.1). Sample units were placed along each transect using the systematic random sampling method. The preserved wetland area was not monitored.

Table 14.3 details the methods used to address each performance criteria by listing each sampling method, sampling area, number of sample units per sampling area, dimensions of each sample unit, and sample unit resolution.



**Figure 14.1 SR 516 Bartol Mitigation Site Sampling Design (2002)**



**Table 14.3 Sampling Method Details.**

Performance Criteria	Monitoring Method	Sampling Area	Number of Sample Units	Sample Unit Dimensions	Resolution
1. Woody, FAC and wetter cover in the wetland	Line intercept	Wetland B	24	34-m lines	0.1 m gap rule <sup>50</sup>
		Wetland C	21	19-m lines	
2. Woody species cover in the buffer	Line intercept	Buffer A	25	15-m lines	0.1 m gap rule
3. Woody species cover on the site	Line intercept	Buffer A	25	15-m lines	0.1 m gap rule
		Wetland B	24	34-m lines	
		Wetland C	21	19-m lines	
4. Shrub and tree height differences	Line intercept	Buffer A	25	15-m lines	0.1 m gap rule
		Wetland B	24	34-m lines	
		Wetland C	21	19-m lines	
5. Invasive, exotic species cover	Point-line	Buffer A	25	15-m point-line	30 points/unit
		Wetland B	41	34-m point-line	68 points/unit
		Wetland C	20	19-m point-line	38 points/unit

Sample size analysis was conducted for Success Standards 1 – 3 and Contingency Plan 5 using the following equation.

$$n = \frac{(z)^2 (s)^2}{(B)^2}$$

z = standard normal deviate  
s = sample standard deviation  
B = precision level<sup>51</sup>  
n = unadjusted sample size

Success Standard 4 was addressed throughout the entire site, both qualitatively through photographs, and quantitatively (Table 14.3). Heights of individual trees and shrubs intercepting the sample units were estimated to the nearest 0.5 m along each line-segment sample unit mentioned above. A two-tailed t-test assuming unequal variances ( $\alpha = 0.05$ ) was conducted to determine if there was a significant difference between the shrub and the tree heights.

Three bird surveys were conducted between mid-May and early July to be used for evaluation of the site's wildlife as indicated in Objective 2 in the mitigation plan. Family and species richness, as well as relative abundance were recorded. Species diversity indices (H) were calculated for each bird survey using the Shannon-Wiener function (Krebs 1999).

<sup>50</sup> Woody plants with canopy gaps less than 0.1 m were considered continuous with no break in cover.

<sup>51</sup> The precision level equals half the maximum acceptable confidence interval width multiplied by the sample mean.

$$H' = -\sum_{i=1}^s (p_i)(\log p_i)$$

$H'$  = index of species diversity

$s$  = number of species

$p_i$  = proportion of sample belonging to  $i$ th species

To determine if an increase in the bird diversity occurred from 2000 to 2002, a one-tailed t-test ( $\alpha = 0.025$ ) assuming unequal variances was performed between the species diversity indices of both years.

## Results and Discussion

Although the success criteria regarding cover for the wetland and buffer areas may not have been achieved in 2002, this site should develop satisfactorily over a slightly longer time frame. It appears that the vegetation structure has changed from a single layer to multiple layers. There also appears to be an increase in bird use of the site in the past three years.

### Success Standard 1 – At Least 80% Woody FAC and Wetter Vegetation in the Wetland

The aerial cover of woody FAC and wetter species was estimated at 31% ( $CI_{80\%} = 22\text{-}39\%$  cover) in wetland B and 52% ( $CI_{80\%} = 43\text{-}61\%$  cover) in wetland C (Figure 15.2). This value does not meet the fifth year Success Standard 1. However, plantings appeared to be well established, and the site may meet the 80% cover standard in the next couple of years. Seven woody FAC and wetter species occurred in wetlands B and C: *Cornus sericea* (redosier dogwood), *Lonicera involucrata* (twinberry), *Physocarpus capitatus* (Pacific ninebark), *Salix scouleriana* (Scouler's willow), *Salix lucida* (Pacific willow), *Salix sitchensis* (Sitka willow), and *Spiraea douglasii* (hardhack).

### Success Standard 2 - At Least 75% Woody Cover in the Buffer Area

The aerial cover of woody species was estimated at 13% ( $CI_{80\%} = 8\text{-}18\%$  cover) in upland buffer A. This value does not meet the fifth year Success Standard 2. Replanting of the buffer would increase the likelihood of meeting this standard in the future.

### Success Standard 3 – At Least 80% Woody Cover on the Entire Site

The aerial cover of woody species was estimated at 13% ( $CI_{80\%} = 8\text{-}18\%$  cover) in buffer A, 39% ( $CI_{80\%} = 31\text{-}46\%$  cover) in wetland B, and 51% ( $CI_{80\%} = 41\text{-}61\%$  cover) in wetland C. All three sampling areas failed to meet woody cover standards (Success Standard 3). This site would benefit from replanting in the buffer area and southern end of the site.



Figure 14.2 SR 516 Bartol wetland B (July 2002)

#### Success Standard 4 - Observable Differences in Height between Shrub and Tree Layers

There appears to be a statistically significant difference between the mean heights of the shrub (2.6m) and tree (5.2m) layers ( $P < 0.01$ ). Photographic documentation (Figure 14.3) supports the quantitative data showing differences between the height of the shrub and tree layers. Therefore, the site meets the requirements of Success Standard 4.

#### Contingency Plan – Less than 10% Invasive Exotic Species Cover

The estimated aerial cover of invasive exotic species was 25% ( $CI_{80\%} = 21\text{-}29\%$  aerial cover) in buffer A, 9% ( $CI_{80\%} = 6\text{-}12\%$  cover) in wetland B, and 54% ( $CI_{80\%} = 44\text{-}64\%$  aerial cover) in wetland C. Despite prior weed control efforts, the estimated cover on the site exceeds that allowed by the contingency. Because the cover estimates exceed the limit, the weed control contingency plan is triggered.

The intent of Objective 2 is provision of additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. A variety of wildlife were observed over the monitoring period, including 33 bird species, 5 of which were wetland-dependent and 7 of which were wetland-associated (Table 14.4). The level of bird activity at the SR 516 Bartol mitigation site seems to have increased over the monitoring period.

Although mean avian family richness remained the same, the mean species richness increased from year 2000 to 2002 (Table 14.5). Correspondingly, there appears to be a statistically significant increase in bird species diversity from year 2000 to 2002 ( $P = 0.021$ ). Using bird species diversity as a measure, the goal of Objective 2 has likely been achieved. Incidental wildlife observations included Blacktail Deer (*Odocoileus hemionus*), garter snakes, and small mammals.



**Figure 14.3** SR 516 Bartol upland buffer (July 2002)

**Table 14.4 SR 516 Bartol Mitigation Site Bird Species Status (1999 – 2002).**

Common Name	Scientific Name	Status <sup>52</sup>
Barn Swallow	<i>Hirundo rustica</i>	Wetland-associated
Black-capped Chickadee	<i>Parus atricapillus</i>	Wetland-associated
Canada Goose	<i>Branta canadensis</i>	Wetland-dependant
Common Yellowthroat	<i>Geothlypis trichas</i>	Wetland-dependant
Killdeer	<i>Charadrius vociferus</i>	Wetland-associated
Mallard	<i>Anas platyrhynchos</i>	Wetland-dependant
Marsh Wren	<i>Cistothorus palustris</i>	Wetland-dependant
Red-winged Blackbird	<i>Agelaius phoeniceus</i>	Wetland-dependant
Tree Swallow	<i>Tachycineta bicolor</i>	Wetland-associated
Violet-green Swallow	<i>Tachycineta thalassina</i>	Wetland-associated
Willow Flycatcher	<i>Empidonax traillii</i>	Wetland-associated
Wilson's Warbler	<i>Wilsonia pusilla</i>	Wetland-associated

**Table 14.5 SR 516 Bartol Mitigation Site Bird Survey Results (2000 and 2002)**

Attribute	Year 2000	Year 2002
Mean Family Richness	11 avian families	11 avian families
Mean Species Richness	13 species	16 species
Species Diversity Index		
Mean H'	1.02	1.14
Standard Error	0.02	0.03
Range	0.97 – 1.05	1.09 – 1.21

## Management Activities

Table 14.6 provides a summary of management activities at this site.

**Table 14.6 Summary of Management Activities SR 516 Bartol Mitigation Site**

Date	Description of Management Activity
2001	Weed control efforts were enacted to eradicate <i>R. armeniacus</i> .
2001	Bonneville Power Administration performed maintenance on woody vegetation that threatened power lines on the site.

<sup>52</sup> Birds are assigned an upland or wetland-dependent species status based on the classification scheme presented in Brown and Smith (1998). Regional variation occurs. Additional references used to further classify bird species include Thomas (1979), Ehrlich et al. (1988), and Smith et al. (1997).

## **Appendices**

## Appendix A

### SR 2 Monroe Fairgrounds Success Standards

#### 4.7.2 Objectives and Performance Standards

##### **Objective 1: Areal Extent and Hydrology**

The wetland mitigation site must be 0.014 ac or larger and must support wetland hydrology. Thus, hydrology will be monitored monthly using shallow groundwater wells or other means to observe and document soil saturation and inundation. The boundary and areal extent of the area supporting wetland hydrology will be determined using an instrument survey or other reliable method of determining area.

##### **Performance Standards: Monitoring Year One (one year after planting)**

S1. In a year of normal precipitation, at least 0.014 ac of the mitigation site supports a hydroperiod that meets the hydrology criterion for wetlands (Environmental Laboratory 1987).

##### **Monitoring Schedule**

Wetland hydrology will be monitored once monthly prior to Monitoring Year One, thence once in Monitoring Years One, Three, and Five. A determination of areal extent will be made in Monitoring Year One.

##### **Potential Contingency Actions**

1. Regrade site.

##### **Objective 2: Vegetation**

The mitigation site is intended to create approximately 0.14 ac of shrub and forested wetland vegetation and 0.136 ac of planted wetland/stream buffer (including the vegetative filter strip), each of which is dominated by native plant species. Wetland vegetation will appear to be succeeding toward a forested community with a shrub understory. This is compared to the impact area, which is predominantly shrub habitat with a reed canarygrass understory.

##### **Performance Standards: Monitoring Year One (one year after planting)**

S2. At the end of the first growing season all planted material shall be alive (100% survival).

##### **Performance Standards: Monitoring Year Three**

S3. Three years after planting, the wetland will be comprised of a planted and native naturally colonizing plant community with 50% or more areal cover of woody plant species.

S4. Three years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 50% or more areal cover of woody plant species.

**S5. Class A noxious weeds listed in Snohomish County will comprise no more than 10% of the relative (adjusted to 100%) areal cover of the entire wetland and buffer site.** Reed canarygrass is expected to be a component of this mitigation effort due to the abundant and adjacent source of propagules, as well as the small size of the mitigation effort (side-lighting). Thus, no performance standards are directed specifically at reed canarygrass. Some control of reed canarygrass is anticipated from the establishment of a woody plant community.

**Performance Standards: Monitoring Year Five**

S6. Five years after planting, the wetland will be comprised of a planted and native naturally colonizing plant community with 80% or more areal cover of woody plant species.

S7. Five years after planting, the buffer will be comprised of a planted and native naturally colonizing plant community with 80% or more areal cover of woody plant species.

**Monitoring Schedule**

Once during Monitoring Years One, Three, and Five.

**Potential Contingency Actions**

- 1. Before the beginning of Monitoring Year One, all dead or unhealthy plants will be replaced. Thus, monitoring 100% survival in Monitoring Year One (Performance Standard S2) will be verifying this.**
2. If the site does not meet Performance Standards S3 and S4 (Monitoring Year Three), additional planting will be conducted. Live, containerized plant material will be replanted and monitored to assure that coverage meets Performance Standards S6 and S7 (Monitoring Year Five).
3. If the site does not meet Performance Standards S6 and S7 (Monitoring Year Five), resource agencies will be consulted for advice on further measures to remedy problems at the site. The monitoring schedule will be extended and such reasonable measures will be conducted as necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland/buffer system.
4. The mitigation plan uses and promotes the growth of native vegetation. Attempts will be made to limit the spread of County-listed Class A noxious weeds, and they will not be allowed to dominate the site. Those species will be controlled immediately as soon as they are identified.

**4.8 Monitoring Plan**

WSDOT (Northwest Region Biology Program) will begin monitoring hydroperiod in the wetland creation portion of the site immediately after completion of the grading plan up to the beginning of Monitoring Year One. During this time period, hydrology will be

monitored at least monthly using shallow groundwater wells or other means of observing soil saturation/inundation.

Beginning with the first growing season after the initial year of planting and plant establishment (Monitoring Year One), WSDOT (Environmental Affairs Office Monitoring Program) will monitor the mitigation site for at least five years. Monitoring will be conducted using procedures outlined in WSDOT (2000) or subsequent updates of published WSDOT monitoring methodologies. Parameters to be monitored during this five-year period include hydroperiod and vegetation, as described above.

Reports for all five years of monitoring (which include a report for each of Monitoring Years One, Three, and Five) will be issued to the Corps of Engineers, Washington State Department of Ecology, the City of Monroe (City of Monroe, Brad Feilberg, 806 West Main Street, Monroe, WA 98272), and other resource agencies for review and comment. Successful mitigation will be measured by attainment of the performance standards described in this mitigation plant document. Monitoring may be curtailed early or reduced in intensity if the mitigation effort meets the stated performance standards earlier than anticipated.

#### **4.9 Contingency Actions**

WSDOT anticipates the mitigation goal will be achieved by accurately completing the grading and planting plans. However, contingency actions, as described above, may be needed to correct unforeseen problems. Such actions may consist of regrading the site in the case of insufficient hydroperiod, or replanting the site in the case of planting failure. However, natural recruitment of native wetland species and upland species (in the buffer) will be counted toward achieving performance standards for Vegetation. Should areal coverage of forest wetland or forested buffer plants consistently fall short of desired performance standards, WSDOT will consult with appropriate agencies in determining what additional measures could be implemented to ensure establishment of viable wetland and upland plant communities.



## Appendix B

### SR 9 Stillaguamish River Success Standards

#### Success Standards

The following excerpt is from the *SR 9 Stillaguamish/Haller Bridge 9/132 Replacement Wetland Mitigation Plan* (WSDOT 1997). Standards of success and contingency plans addressed this year are identified in **bold** font.

The proposed compensatory mitigation is intended to replace wetland types, acreage, and functions and values which will be lost due to wetland impacts associated with the proposed project. The proposed mitigation intends to create 0.96 hectares (2.37 ac) of wetland with plantings of native vegetation to achieve Palustrine emergent, scrub-shrub, and forested vegetative classes as mitigation for the loss of 0.33 wetland hectares (0.82 ac). A wetland buffer of 0.69 hectares (1.71 ac) is proposed. The created wetland is anticipated to provide the following functions and values:

- wildlife habitat – through increasing the available shrub and tree cover and habitat structures;
- floodflow alteration – through increasing the amount and diversity of vegetative forms and the addition of organic soils;
- contaminant buffering - by providing a well vegetated wetland area to intercept sediment and contaminants.

**Objective 1:** The compensatory mitigation site will include approximately 0.96 ha (2.37 ac) of emergent, forested, and scrub-shrub wetland vegetation and 0.69 ha (1.71 ac) of planted wetland buffer. The proposed wetland will have an initial planting of 31% emergent, 55% scrub-shrub, and 14% forest/ scrub-shrub vegetation.

#### Performance Standard:

##### First Year:

- During the first year plant establishment, planted species that are dead or unsatisfactory shall be replaced. Maintaining a weed free condition and irrigation as necessary to ensure continued growth shall be accomplished.

##### Third Year:

- **After three years the wetland will be comprised of 75% or greater native facultative or wetter species, or will be comprised of a planted and native naturally colonizing plant community at 50% or greater areal cover.**
- **After three years the buffer will have 75% cover of native species or will be comprised of a planted and native naturally colonizing plant community at 50% or greater areal cover.**

Fifth Year:

- After five years the wetland will be comprised of 75% or greater native facultative or wetter species or will be comprised of a planted and native naturally colonizing plant community at 80% or greater areal cover.
- After five years the buffer will have 75% cover of native species or will be comprised of a planted and native naturally colonizing plant community at 80% or greater areal cover.

**Objective 2:** Wildlife cover and forage availability for birds and small mammals should increase substantially. The addition of stumps, logs and brush piles will increase habitat diversity and structure in the newly vegetation areas. Overall, creating an emergent and scrub-shrub wetland will likely provide feeding, breeding, and resting habitat for birds, small mammals, and amphibians

Performance Standard:

**Third Year:**

- **After three years increases in wildlife cover and forage species should improve habitat structure which should result in a corresponding increase in wildlife use.**

Fifth year:

- After five years wildlife cover and forage species should be established to where habitat structure will change from a single layer of vegetation to multiple layers. An increase in wildlife species should be observable.

Contingency Plan:

Mitigation goals should be accomplished through successful completion of the planting plan. Contingency plans will ultimately consist of replanting the site in the case of planting failure or other unforeseen problems. The natural recruitment of native wetland species and upland species (to the buffer) throughout the mitigation site will assist any revegetation contingency plan.

In the event that the areal coverage of forest wetland or forested buffer plants falls short of the listed performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community at the site.

The following schedule summarizes how we assure achievement of performance standards and mitigation goals:

**If the site does not have a minimum of 50% areal coverage after the third growing season additional planting will be performed. Sprigs, cuttings, seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.**

If the site does not meet the standards of success for vegetative cover after the fifth growing season, resource agencies will be consulted for advice on further measures to

remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.

The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. **A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species.**

### **Operation and Maintenance**

The goal of the wetland mitigation site is to create a functional self-sustaining system that should require very little maintenance. Once the vegetation establishes, minimum disturbance will occur. WSDOT will retain the site in perpetuity. Maintenance will be performed by WSDOT personnel and would be confined to repairing vandalism, erosion damage, minor revegetation (if necessary), trash collection, and weed control.

### **Monitoring**

The site will be monitored by WSDOT for a minimum of five years following mitigation construction and planting. The monitoring will be performed according to procedures outlined in WSDOT's Monitoring Methods (1996 Wetland Mitigation Monitoring Report). Monitoring reports will be issued annually to the Corps of Engineers, Department of Ecology, and other resource agencies or local governments for review and comment. Successful mitigation will be measured by attainment of performance standards listed in the goals and objectives section of this document.

### **Additional Permit Requirements**

**Dept Ecology SO3-003-86**

**Water Quality Certification Order #97-4-00669, page 3:**

**7. As-Built and Monitoring Reports: an As-Built report documenting the final design of the mitigation area shall be prepared when site construction is completed. The report shall include the following:**

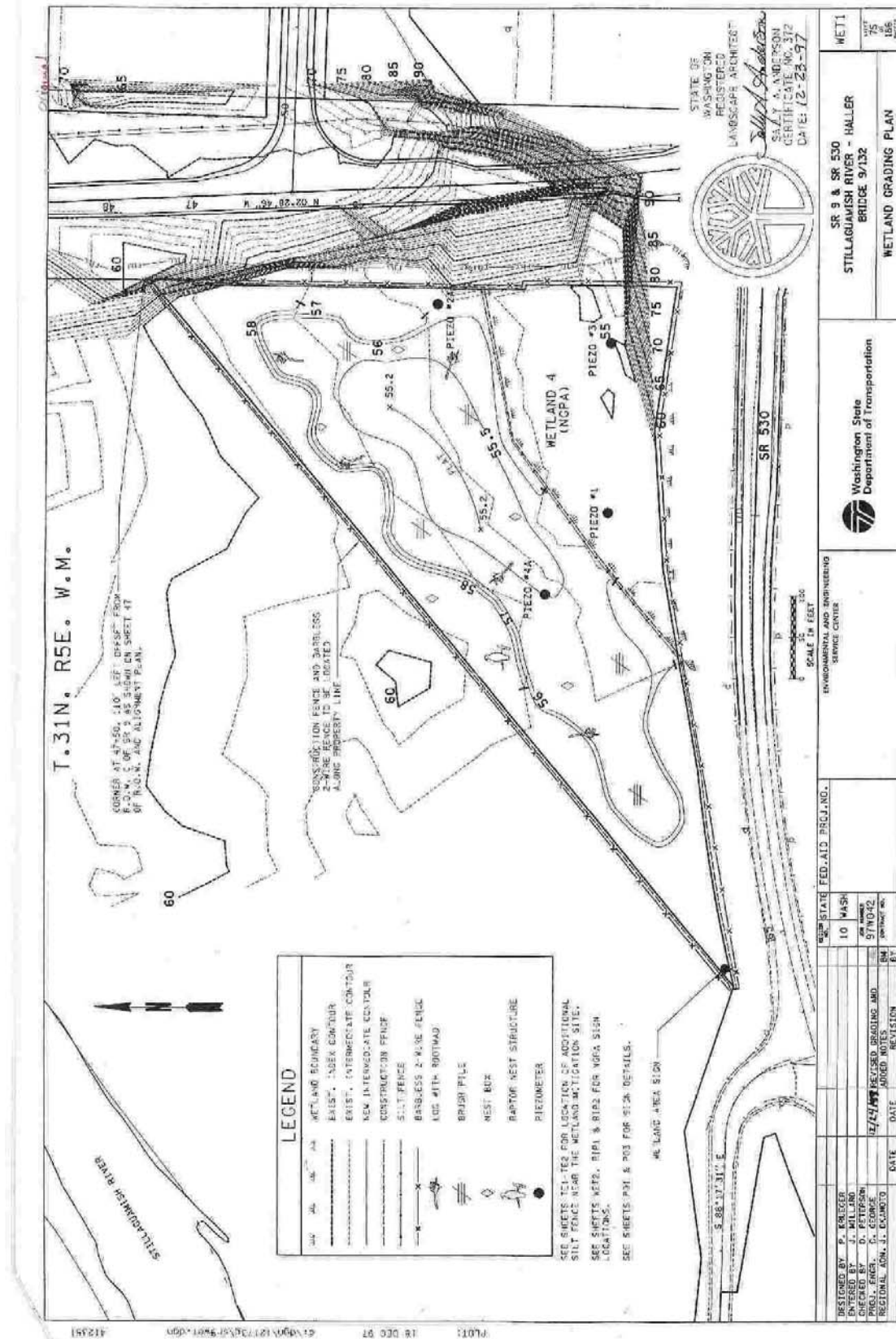
- **Final site topography and stream elevations;**
  - Please refer to attached grading plan.
- **Description of the one-foot of backfilled organic soil;**
  - Existing soil was mixed with 2200 cubic yards of organic compost to meet the prescribed percentage of 30 percent.
- **Photographs of the area taken from established permanent reference points;**
  - Please refer to Figure 4.2.
- **A planting plan showing densities, sizes, and approximate locations of plants, as well as plant sources and the time of planting;**
  - Please refer to attached plans.

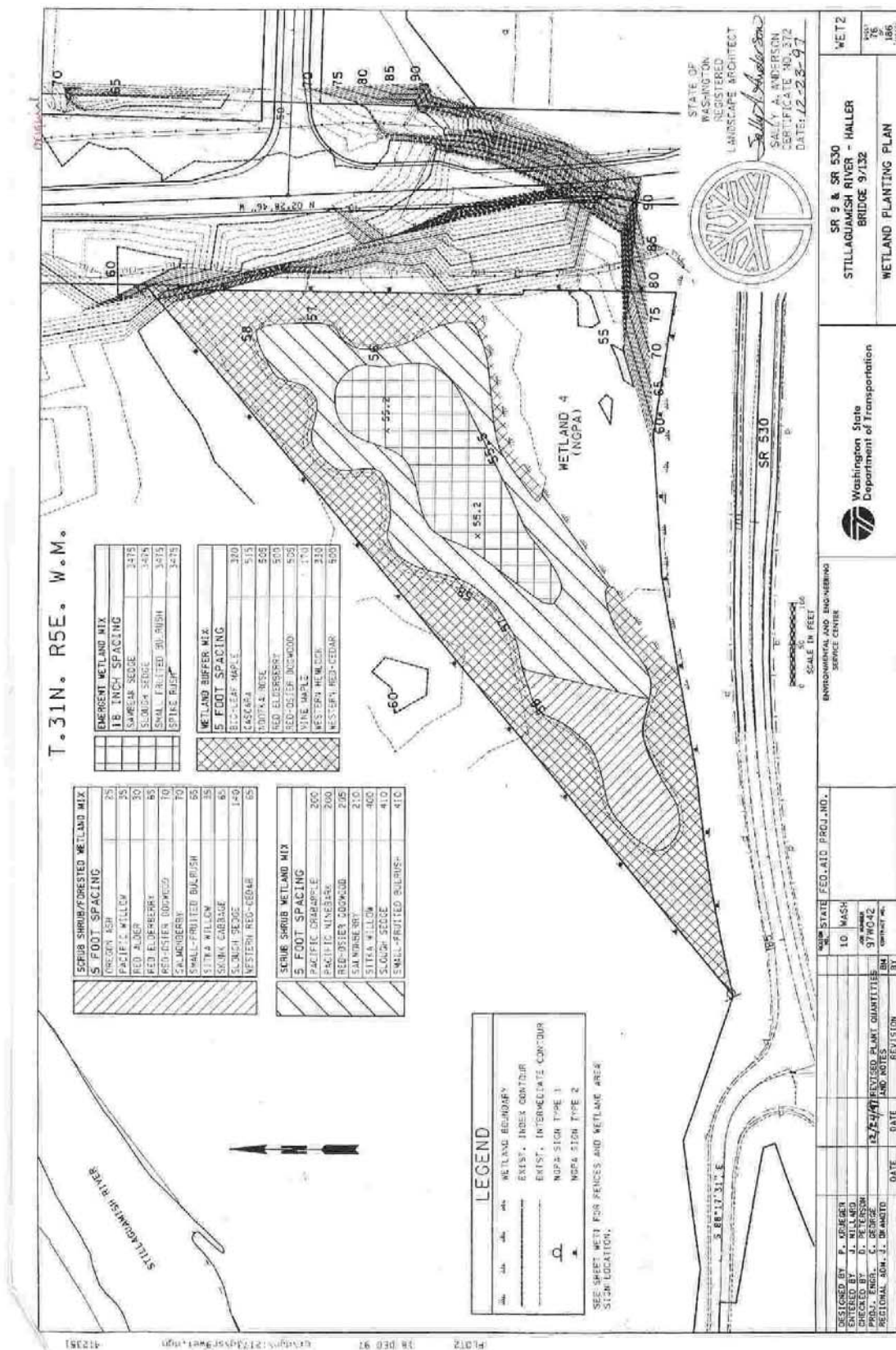
- The following sources were used to provide the plant materials for the project:
  - P & G Landscaping, Inc. Nursery Division, Snohomish, WA
  - Watershed Garden Works, Longview, WA
  - Judd Creek Wetland Nursery, Vashon Island, WA
  - Hutchinson Nursery Sales Ltd., Surrey, B.C.
  - Trillium Gardens, Pleasant Hill, OR
  - Storm Lake Growers, Snohomish, WA
  - Linnaea Nursery, Langley, B.C.
- **Habitat features installed and their locations;**
  - Please refer to attached grading plan.
- **Any changes to the plan that occurred during construction.**
  - Please refer to attached planting plan.

**A monitoring report shall be prepared at Year 3 of the project showing the elements listed above for the “As-Built” report.**

The “As-Built” report shall be sent to Ecology’s Sandra Manning within sixty days of completing project construction. The monitoring report shall be sent to Ecology’s Sandra Manning within sixty days of completing the Year 3 vegetation monitoring event.

**For additional information, please refer to the SR 9 Haller Bridge Mitigation Site “As-Built” Report dated June 14, 2000.**







## PLANT MATERIAL LIST

BOTANICAL NAME	COMMON NAME	QUANTITY	SIZE	ROOT CONDITION	REMARKS
<b>TREES</b>					
ACER CIRCINATUM	VINE MAPLE	275	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
ACER MACROPHYLLUM	BIG LEAF MAPLE	1625	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
ALNUS RUPESTRIS	BARK ALDER	100	18 IN. HT.	BARE ROOT	1/2" CALIPER, SINGLE STEM, 10" ROOT SPREAD
FRAXINUS LATIFOLIA	OREGON ASH	25	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
PSUDOTSUGA MEXICANA	Oregon Fir	790	18 IN. HT.	#1 CONTAINER	3/4" CALIPER, 2 YR. SEEDLING
QUERCUS PUMILA	CASCARA	625	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
THUJA PLICATA	WESTERN RED CEDAR	565	18 IN. HT.	#1 CONTAINER	3/4" CALIPER, 2 YR. SEEDLING
TSUGA HENRYANA	WESTERN HEMLOCK	565	18 IN. HT.	#1 CONTAINER	3/4" CALIPER, 2 YR. SEEDLING
<b>SHRUBS</b>					
CORUS SERICEA	RED OSIER DOGWOOD	1100	18 IN. HT.	BARE ROOT	1/2" CALIPER, 2 CANE MINIMUM, 10" ROOT SPREAD
GALTERIA SHALON	SALAL	165	18 IN. HT.	#1 CONTAINER	WELL-DEVELOPED ROOT SYSTEM
HOLDISCUS DISCOLOR	OCEAN SPRAY	1420	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
INDICA PLUM	INDIAN PLUM	200	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
PHYLLIS CARPENTER	PACIFIC CHERRY	200	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
PHYLLIS CARPENTER	PACIFIC KIDNEY	200	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
ROSA NUTKANA	NUTKANA ROSE	2225	18 IN. HT.	BARE ROOT	1/2" CALIPER, 2 CANE MINIMUM, 10" ROOT SPREAD
RUBUS PARVIFLORUS	THIMBLEBERRY	165	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
RUBUS SPECIOSUS	CALDWELLBERRY	600	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
SAMOLUS ROSEMOSSA	RED EMBERBERRY	1425	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
SYMPHORICARPOS ALBUS	SNOWBERRY	290	18 IN. HT.	BARE ROOT	1/2" CALIPER, 10" ROOT SPREAD
<b>LIVE STAKES</b>					
POPULUS TRECHOCARPA	BLACK COTTONWOOD	80	3 FT. HT.	LIVE STAKE	FIELD COLLECTIBLE, 1/2" - 1" DIAM.
POPULUS LASIOCARPA	PACIFIC WILLOW	85	3 FT. HT.	LIVE STAKE	FIELD COLLECTIBLE, 1/2" - 1" DIAM.
SALIX SITCHENSIS	SITKA WILLOW	635	3 FT. HT.	LIVE STAKE	FIELD COLLECTIBLE, 1/2" - 1" DIAM.
<b>EMERGENTS</b>					
CAREX OBLATA	SLOUGH SEDGE	4025	3 IN. SPREAD	BARE ROOT	ONE GROWTH POINT, 6" TOP GROWTH
CAREX STIPATA	SANDPAPER SEDGE	3475	3 IN. SPREAD	BARE ROOT	ONE GROWTH POINT, 6" TOP GROWTH
ELEDORHIS PALUSTRIS	SPRING RUSH	3475	3 IN. SPREAD	BARE ROOT	ONE GROWTH POINT, 6" TOP GROWTH
LYSTICHATUM AMERICANUM	SKUNK CABBAGE	65	3 IN. SPREAD	#1 CONTAINER	WELL-DEVELOPED ROOT SYSTEM
SCIRPUS MACROCARPUS	SMALL-FRUITED BURRUSH	3950	3 IN. SPREAD	BARE ROOT	ONE GROWTH POINT, 6" TOP GROWTH

## NOTES:

- ALL PLANTS MUST MEET THE REQUIREMENTS OF SECTION 9-14.6 OF THE STANDARD SPECIFICATIONS AND SPECIAL PROVISIONS.
- ALL PLANTS SHALL BE RANDOMLY MIXED WITHIN EACH PLANT ZONE, UNLESS NOTED OTHERWISE.
- SEE PLANS FOR PLANT SPACING.
- CALIPER MEASUREMENT TO BE TAKEN AT ROOT COLLAR OR GROUND LEVEL.



STATE OF  
WASHINGTON  
REGISTERED  
LANDSCAPE ARCHITECT  
Sally A. Anderson  
CERTIFICATE NO. 212  
DATE 12-25-97

DESIGNED BY J. MILLER	DATE	REVISION	DATE	REVISION
CHECKED BY D. PETERSON	DATE	REVISION	DATE	REVISION
PROJECT ENGINEER C. GEORGE	DATE	REVISION	DATE	REVISION
REGIONAL ADMIN. J. KRANTZ	DATE	REVISION	DATE	REVISION
WASHINGTON STATE Department of Transportation 				
ENVIRONMENTAL AND ENGINEERING SERVICE CENTER				
SR 9 & SR 530 STILLAGAMISH RIVER - MALLER BRIDGE 9/132 PLANT MATERIAL LIST				
PML 10/1 10/2 10/3 10/4 10/5 10/6 10/7 10/8 10/9 10/10				

## Appendix C

### SR 18 Holder Creek #2 Success Standards

#### Success Standards

The following excerpt is from the SR 18 Holder Creek Vicinity Slope Stabilization Sensitive Area Mitigation Plan (Mesich and Steinmetz 2000). Additional permit requirements are excerpted from U. S. Army Corps of Engineers NWP 98-4-02323. The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

#### OBJECTIVES AND STANDARDS OF SUCCESS

##### Objective: Wetland Vegetation

Mitigation will restore the existing wetland on site.

##### First Year

- **Plant establishment will be assessed, and all dead or inadequately planted species will be replaced.**
- **Non-native invasive plants shall not make up more than 10% of cover in any growing season.**

##### Third Year

- Shrub cover shall be greater than 30% in third year.

##### Fifth Year

- Plant establishment will be assessed, and all dead or inadequately planted species will be replaced to ensure an 80% survival rate of planted species.
- Shrub cover shall be greater than 50% in the fifth year.
- Non-native invasive plants shall not make up more than 10% of cover in any growing season.

##### Objective: Buffer Vegetation

Mitigation will restore sensitive area buffering.

##### First Year

- **Plant establishment will be assessed, and all dead or inadequately planted species will be replaced.**

##### Third Year

- Shrub cover shall be greater than 30% in the third year.

##### Fifth Year

- Plant establishment will be assessed, and all dead or inadequately planted species will be replaced to ensure an 80% survival rate of planted species.
- Shrub cover shall be greater than 50% in the fifth year.



- Non-native invasive plants shall not make up more than 10% of cover in any growing season.

## **MONITORING**

The mitigation site will be monitored in the third and fifth years over a period of five years. Monitoring will be in accordance with WSDOT protocol. Monitoring and tracking all WSDOT mitigation projects are completed under Sections 404/410 of the Clean Air Act, for determining compliance with permits, and for meeting requirements specified by local governments in implementation of the Growth Management Act.

WSDOT monitoring conducts its monitoring program from May through September. Monitoring reports are completed annually and submitted to the U.S. Army Corps of Engineers, Washington Department of Ecology, and this case local jurisdiction King County DDES.

### **From King County Clearing and Grading Permit LL CG504 (p. 37-38)**

A five year monitoring plan for stream and/or wetland mitigation shall commence upon implementation of the mitigation plan. Yearly monitoring reports shall be submitted to DDES for review and comment. If the mitigation goals and objectives are not met at the end of the monitoring period, the Engineer will be responsible for the preparation and completion of a contingency plan to remedy the situation. The Engineer shall request, in writing, and inspection from DDES upon final implementation of the mitigation plan by the construction office. The Engineer will monitor the site for a period of 5 years to ensure survival of the plant material, control of erosion and control of non-native plant species. At the end of 5 years, the following performance standards will be met:

- 80% of each species of the required vegetation will have survived.
- **Shrub cover shall be greater than 10% after one year**, greater than 30% after two years and greater than 50% after three years.
- **Non-native invasive plants shall not make up more than 10% of cover in any growing season.**
- **All erosion features, rills, slumps, and gullies shall be repaired immediately with temporary measures and replanted within the planting timelines set out in the special provisions of the mitigation plan.**
- Monitoring reports shall be submitted to King County DDES by October 31 each year of the monitoring period. The monitoring reports shall consist of the following:

**A calculation indicating percent shrub cover over the entire site:**

$$\bar{x} = \frac{\sum (hits/points)}{n} = \frac{2.25}{73} = 3\% \text{ aerial cover}$$

$\bar{x}$  = sample mean  
 $n$  = sample size

Raw data is available on request.

**Percent of planted materials surviving, classified by condition (example: vigorous, living, stressed).** (See report)

**A calculation of the percent cover of non-native invasive vegetation.**

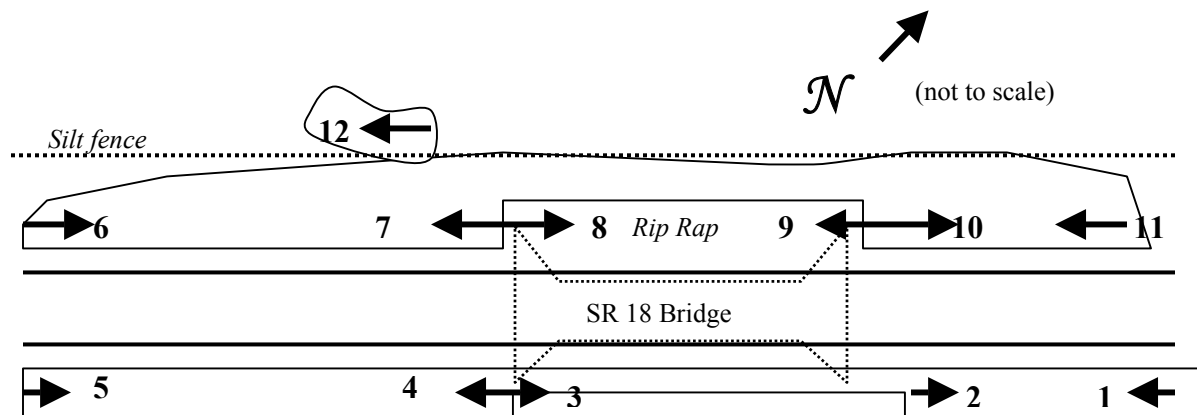
$$\bar{x} = \frac{\sum (hits/points)}{n} = \frac{0.75}{73} = 1\% \text{ aerial cover}$$

$\bar{x}$  = sample mean  
 $n$  = sample size

Raw data is available on request.

**Identification of maintenance concerns:** Erosion features, rills, slumps, and gullies were not observed.

**At least twelve original 4 x 6 original color photographs that show the entire planting site, taken from photo points drawn on a map of the planting area and keyed to lines of sight from those photo-points.**



**Figure 17.1 SR 18 Holder Creek #2 Sketch with Photograph Locations**



**Figure 17.2 Photo 1**



**Figure 17.3 Photo 2**





**Figure 17.4 Photo 3**



**Figure 17.5 Photo 4**





**Figure 17.6 Photo 5**



**Figure 17.7 Photo 6**





**Figure 17.8 Photo 7**



**Figure 17.9 Photo 8**





**Figure 17.10 Photo 9**



**Figure 17.11 Photo 10**





**Figure 17.12 Photo 11**



**Figure 17.13 Photo 12**



## Appendix D

### SR 18 Pumpkin Patch Success Standards

The following excerpt is from the *Wetland Mitigation Plan State Route 18 Auburn-Black Diamond Road to SE 312<sup>th</sup> Way* (Null 1993). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

**Goals:** The goal of this mitigation project is to restore and preserve wetland/riparian habitat. It will be accomplished by the following activities:

- 1) Restoring a wetland;
- 2) enhancing existing wetland/riparian areas with native plantings;
- 3) preserving existing wetland/riparian areas by maintaining permanent state ownership.

In general, the mitigation site is eventually intended to provide wildlife habitat, food chain support, flood storage, biofiltration, and sediment and nutrient trapping. Annual monitoring of the site should indicate whether or not these functions will occur. In due time, it should also possess a multi-canopy structure along with density and species diversity similar to that of the impacted areas.

**Objectives and Performance Standards:** The following objectives and performance standards establish specific criteria that will be used by WSDOT and regulatory agencies to measure the success of the mitigation site. Baseline data of the fill area will be used in assessing these standards for the mitigation site. The objectives specify direct actions, which are necessary to achieve the mitigation goal. The performance standards provide the specific measurements used to evaluate whether or not the goals and objectives are being met. These objectives will be measures and tracked during annual site monitoring.

Objective #1: Wetland restoration. Restore a wetland system that has vegetation, which will provide structural and species diversity currently provided by the red alder/willow/dogwood forest adjacent to the mitigation site.

Standards of success:

After three years:

- The wetland has 75% survival of facultative (FAC) or wetter species without reed canarygrass, or is supplemented or replaced by a native naturally colonizing plant community at 75% or greater cover.
- Two wetland classes; scrub-shrub and forested will be established.

**After five years:**

- **Wetland has about 35-50% scrub-shrub coverage;**
- **Wetland has about 50-80% forested coverage;**
- **Both scrub-shrub and forested wetland is 90% native species;**
- **Scrub-shrub community must have at least two species with 30% areal coverage each;**
- **Forested community must have at least two species with 40% areal coverage each;**
- **Wetland has 90% viability of all trees planted in the forested zone.**

Objective #2: Provide wildlife support. Wildlife habitat for wetland dependent and other species will be increased as compared to the existing habitat value provided by the site. Restoration of habitat will focus on increasing both habitat diversity (number of habitat types present) and habitat complexity (number and extent of canopy levels) through development of a native vegetative community.

The existing riparian corridor will be expanded by adding the mitigation site, and making it contiguous with the adjacent wetland system associated with the Green River. Cover and forage availability for birds and small mammals should increase significantly with the addition of planted species such as red-osier dogwood, salmonberry, Oregon ash, red alder, and black cottonwood. Even with minimal revegetation survival rates, there should be habitat improvement.

The mitigation site is also intended to provide fish habitat, but only during the winter months and storm events. This habitat will be supplied by the construction of a side channel, and is considered a fisheries enhancement. It will be constructed so that entrapment does not occur.

Wildlife habitat will be measured by the areal cover of woody vegetation, the number of wetland classes, and availability of seasonal standing water. This measurement will be used as an indicator of an increase in habitat structure and diversity. The site is expected to change from a system with a single layer to a more complex system as the shrub and forest layers become established.

Standard of Success:

**After three years:**

- Two wetland classes will occur.
- Sapling trees should be established.
- At least 1000 feet of ecotone habitat will be created as measured by an increase in the edge between different habitat types over the pre-construction site conditions.

**After five years:**

- **Two wetland classes; scrub-shrub and forested will occur.**
- **Seasonal standing water may occur from December through March in the side channel to encourage water-dependent species activity.**
- **An increase in wildlife species should be observable, especially for amphibians and passerines.**

Objective #3: Establishment of a buffer. A buffer of native upland and transitional plants is proposed along the mitigation site's southern and westerly edges to cushion both wildlife and the new plantings from external disturbance. An additional buffer will come from revegetating the existing steep embankment to the north. The existing undisturbed native vegetation will provide a buffer along the site's northeasterly and southeasterly sides.

Standard of Success:

After three years:

- The buffer has 50-75% areal coverage of native species planted or is supplemented or replaced by native vegetation at 75% or greater cover.

After five years:

- **The buffer has 75-80% areal coverage of native species.**
- **The buffer width will range from 10 to 50 feet as shown on design plans in Appendix 5, and be measurable.**

Objective #4: Wetland preservation. The mitigation site as well as adjacent pre-existing wetland areas will be left undisturbed, and be protected in perpetuity by permanent WSDOT ownership.

**Contingency Plans**

Mitigation goals will be accomplished with successful native plantings. Contingency plans will ultimately consist of replanting of the site in case of planting failure or other unforeseen problems. The natural recruitment of native wetland species throughout the mitigation site will assist any revegetation contingency plan.

## Appendix E

### SR 18 Issaquah-Hobart Success Standards

#### Success Standards

The following excerpt is from the *SR 18 Issaquah-Hobart Interchange and Raging River Bridge Wetland Mitigation Plan* (WSDOT 1993). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

#### Goals

The goal of the SR 18/Issaquah-Hobart Road Interchange wetland mitigation project is to create a forested wetland and forested upland buffer as in-kind mitigation for impacts to 0.16 acre of high quality forested wetland and 1.93 acres of buffer. In general, the created wetland, wetland buffer, and riparian buffer are expected to provide the following functions and values: fish and wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

#### Objectives and Performance Standards

The following objectives and performance standards establish specific criteria that will be used by WSDOT to measure the mitigation site's success.

#### Objective 1 – Vegetation

The mitigation site will include 0.4 acres of forested wetland, 2.16 acres of wetland buffer and 1.25 acres of riparian buffer along Holder Creek. The vegetation planted will provide value as food chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to the existing site conditions. The riparian vegetation planted along Holder Creek will assist in protection and enhancement of instream habitat. As this vegetation matures it will assist in providing shade, winter cover, and recruitment of large organic debris that will be available to enhance in-stream habitat.

#### Performance standards

##### After 3 years:

- 1a. The forested wetland should have 70 percent viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.
- 1b. The wetland should have 50 percent areal coverage of forested and scrub-shrub species.

**After 5 years:**

- 1c. **The wetland should have 80 percent areal cover of forested and scrub-shrub wetland vegetation.**

**Objective 2 – Wildlife**

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with the more mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetation areas. The created wetland will change over time from a largely bare fill area to a wetland dominated by woody vegetation. Overall, the creation of a forested wetland adjacent to Holder Creek will function to increase the value of the existing riparian habitat by providing additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians. The mitigation site also assists in the extending vegetated corridor available for wildlife movement along Holder Creek. Implementation of the mitigation plan will result in the increase in habitat and the edge between habitat types.

**Performance Standards**

**After 3 years:**

- 2a. The forested wetland, wetland buffer, and riparian buffer should have 70 percent viability of planted tree and shrub species;
- 2b. There will be at least six habitat structures (logs, stumps, snags, brush piles) within the boundary of the created wetland and at least twelve within the buffer area. These structures will provide perches, cover, and habitat diversity as planted vegetation matures.
- 2c. There will be at least 400 linear feet of edge between forested wetland and upland.

**After 5 years:**

- 2d. **Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.**
- 2e. The mitigation site should have 80 percent areal cover of trees and shrubs.

**Objective #3: Buffers**

There will be 2.24 acres of forested wetland buffer surrounding the created wetland. In addition to this there will be 2.32 acres of riparian buffer replaced along Holder Creek.

**After 3 years:**

- 3a.** Upland and riparian forested buffer areas should have 50 percent cover by forested species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 50 percent or greater cover.

**After 5 years:**

- 3b.** Upland and riparian forested buffer areas should have 75 percent cover by forested buffer species planted, or be supplemented or replaced by a native naturally colonizing upland forested plant community at 75 percent or greater cover.

**Objective #4 – Preservation**

All areas proposed for preservation will be maintained in the permanent state ownership by WSDOT and will be so labeled on R/W plan sheets on file at WSDOT.

**Contingency Plans**

Mitigation goals will be accomplished with successful native vegetation plantings. Contingency plans will ultimately consist of replanting the site in case of planting failure or other unforeseen problems. The natural recruitment of native wetland species and upland species (to the buffer) throughout the mitigation site will assist any revegetation contingency plan.

In the event that the aerial coverage of forest wetland of forested buffer plants falls short of the listed performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community at the site.

The following schedule summarizes how we assure achievement of performance standards and mitigation goals:

1. If the coverage of trees is less than 50 percent after the third growing season these species will be replanted. Sprigs, cuttings, seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.
2. **If aerial coverage of wetland plants is less than 50 percent after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.**

3. The mitigation plan is designed to utilize and promote the growth of native vegetation. **Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site.** Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. **A weed control program will be implemented if more than 10 percent of the wetland is invaded by invasive exotic species.**

#### **Operation and Maintenance**

The goal of the wetland mitigation site is to create a functional self-sustaining system that should require very little maintenance. Once the vegetation establishes, minimum disturbance will occur. The contractor will be responsible for plant survival of plant materials for a three year period after initial planting acceptance. After this period, maintenance will be performed by WSDOT personnel and would be confined to repairing vandalism, erosion damage, minor revegetation (if necessary), and weed control.

## Appendix F

### SR 18 Kendal and SR 516 Bartol Success Standards

#### Success Standards

The following excerpt is from the *SR 18 SE 304th Street to Covington Way Wetland Mitigation Plan* (Davis 1994). The standards addressed the year are identified in **bold** font. Other standards have been addressed in the indicated monitoring year.

#### Goals, Objectives and Standards of Success

The goals for the SR 18 SE 304<sup>th</sup> Street to Covington Way wetland mitigation project is create and enhance forested scrub-shrub wetland and buffer as in-kind mitigation for impacts to 0.7 ha (1.77 ac) wetland and 0.82 ha (2.05 ac) of buffer. In general, the created wetland, wetland buffer, and riparian buffer are expected to provide the following functions: fish and wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

#### Objective #1 – Vegetation

The mitigation sites will include 2.57 ha (6.43 ac) of forested and scrub-shrub wetland and 1 ha (2.5 ac) of wetland buffer. The vegetation planted will provide value as food-chain support, as well as the functions of flood attenuation, and sediment and nutrient trapping as compared to existing site conditions. The riparian vegetation planted along Big Soos Creek will assist in protection and enhancement of in-stream habitat. As this vegetation matures, it will assist in providing shade, winter cover, and recruitment of large organic debris that will be available to enhance in-stream habitat.

#### Performance Standards:

After three years:

- The forested wetland should have 70% viability of planted species or be supplemented by natural recruitment of native facultative or wetter native wetland species.
- The wetland should have 50% areal coverage of forested and scrub-shrub species.

After five years:

- **The wetland should have 80% areal cover of forested and scrub-shrub wetland vegetation.**

#### Objective #2 - Wildlife

Wildlife habitat diversity will be increased by additions of native species plantings and from the combination of the establishment of early seral vegetation with more the mature forested vegetation existing at the site. The addition of stumps, logs, and brush piles will increase habitat diversity and structure in the newly vegetated areas. **Overall, the creation of a forested wetland adjacent to Big Soos Creek will function to increase the value of the existing riparian habitat by providing additional feeding, breeding, and resting habitat for birds, small mammals, and amphibians.** The mitigation plan also assists in extending the vegetated corridor available for wildlife movement along Big



Soos Creek. Implementation of the mitigation plan will result in the increase in habitat and edge between habitat types.

Performance Standards:

After three years:

- The forested wetland, wetland buffer, and riparian buffer should have 70% viability of planted tree and shrub species.
- There will be at least four habitat structures (logs, stumps, snags, brush piles) within the boundary of the wetland mitigation site at SR 18 and five habitat structures (logs, stumps, snags, brush piles) within boundary of the wetland mitigation site at SR 516. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.

After five years:

- **Habitat structure will change from a single layer of vegetation to multiple layers over time as trees and shrubs mature. Differences in height between shrub and tree layers will be observed.**
- **The mitigation site should have 80% areal cover of trees and shrubs.**

**Objective #3 - Buffers**

There will be 0.77 ha (1.91 ac) of forested and scrub-shrub wetland buffer surrounding the created wetland at SR 18 and 0.23 ha (0.58 ac) of forested and scrub-shrub wetland buffer surrounding the created wetland at SR 516.

Performance Standard:

After three years:

- Upland and riparian forested buffer areas should have 50% cover by forested species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 50% or greater cover.

After five years:

- **Upland and riparian forested buffer areas should have 75% cover by forested buffer species planted, or be supplemented or replaced by native naturally colonizing upland forested plant community at 75% or greater cover.**

## Contingency Plans

1. If the coverage of trees is less than 50 percent after the third growing season these species will be replanted. Sprigs, cuttings seeds or live plant material will be replanted and monitored to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.
2. **If areal coverage of wetland plants is less than 50 percent after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.**
3. The mitigation plan is designed to utilize and promote growth of native vegetation. Attempts will be made to limit the spread of exotic species and they will not be allowed to dominate the site. Noxious weeds, such as purple loosestrife will be eliminated immediately if found occurring on the site, before large populations can establish. **A weed control program will be implemented if more than 10 percent of the wetland is invaded by invasive exotic species.**

## Appendix G

### SR 99 First Avenue South Success Standards

The following excerpt is from the *First Avenue South New Bridge Project Detailed Wetland Mitigation Plan* (WSDOT 1994). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

#### Goals, Objectives and Standards of Success

The goal of the 1<sup>st</sup> Ave Bridge South wetland mitigation project is to create a self sustaining estuarine palustrine emergent wetland that will be of higher value than the degraded area it will replace. Wetland manageability and viability will be enhanced by the establishment of upland buffer. In general, the created wetland system is expected to provide the following functions and values: wildlife habitat, food chain support, water storage and attenuation, and sediment and nutrient trapping.

Excavation and contour grading combined with vegetation establishment will be used to alter the existing site conditions from a predominantly degraded area to an emergent inter-tidal wetland. The surrounding buffer will provide habitat and protect the site from human intrusion and noise and glare associated with adjacent roadways.

#### Objectives and Performance Standards

The following objectives and performance standards establish specific criteria that will be used by WSDOT and regulatory agencies to measure the mitigation site's success. The objectives below specify the direct actions that are necessary to achieve the goal of the mitigation project. The performance standards provide the specific measurements used to evaluate whether the goals and objectives are being met.

#### Objective 1 – Vegetation

This mitigation site will have a vegetation structure and species diversity of higher quality when compared to the existing degraded wetland and upland at the site.

#### Performance Standards

After 3 years:

1a. The wetland has 50 survival of facultative or wetter species, or is supplemented or replaced by a native wetland plant community regenerating at 50% or greater cover.

1b. One wetland class (emergent wetland) will be established within the created channel.

After 5 years:

**1c. The wetland has 75-80% cover by emergent vegetation of facultative or wetter species.**

**1d. Emergent wetland has 75% or greater dominance of native species.**

**Objective 2 – Wildlife**

Wildlife habitat diversity will be increased by additions of native species plantings in the wetland channel and the buffer vegetation adjacent to the channel. The addition of artificial nesting sites, stumps, logs, and brush piles will increase the habitat diversity and structure in the newly vegetated areas. The created wetland will change over time from an area consisting of fill to a wetland dominated by emergent vegetation. Implementation of the mitigation plant will result in the increase in habitat and the edge between habitat types.

**Performance Standards**

After 3 years:

- 2a. The emergent wetland and wetland buffer should have 50% viability of planted tree and shrub species.
- 2b. Two habitat types, emergent wetland and upland buffer will occur at the site.
- 2c. There will be at least eight habitat structures (logs, stumps, snags, brush piles) within the boundary of the mitigation site. These structures will provide perches, cover, and habitat diversity as the planted vegetation matures.
- 2d. There will at least 3,000 linear feet of edge between wetland and upland.

After 5 years:

- 2e. Habitat structure will change from a single layer of vegetation to multiple layers over time as trees, shrubs and emergents mature.**
- 2f. The wetland system will be dominated by emergent vegetation and will be tidally inundated twice each day.**
- 2g. The mitigation site should have 75-80% cover by emergent vegetation of FAC or wetter species.

**Objective #3: Buffers**

There will be at least 50 feet of forested/scrub/shrub upland buffer surrounding the created channel.

**Performance Standards**

After 3 years:

- 3a. The upland buffer area should have 30-50% cover by forested and shrub species planted, or be supplemented or replaced by a native naturally colonizing upland plant community at 50% or greater cover.

**After 5 years:**

**3b. Upland forested/shrub buffer area should have 75% cover by species planted, or be supplemented or replaced by a native naturally colonizing upland plant community at 75% or greater cover.**

**3c. Buffer width will average between 30-50 feet.**

### **Contingency Plans**

Mitigation goals will be accomplished with successful native plant seeding. Contingency plans will ultimately consist of planting the site in case of seeding failure or other unforeseen problems. The natural recruitment of native wetland species and upland species (to the buffer) through the mitigation site will assist any revegetation contingency plan.

In the event that the aerial coverage of wetland or buffer plants falls short of the listed performance standards, additional measures will be employed to assure the establishment of a viable wetland plant community at the site.

The following schedule summarizes how we assure achievement of performance standards and mitigation goals:

1. If the coverage of emergent vegetation is less than 25% after the third growing season the process of seeding should be reconsidered over the planting of seedlings. Sprigs, cuttings, or live plant material might be planted and monitored closely to assure that coverage meets performance standard criteria. Remedial work may occur if hydrology is not sufficient to support wetland vegetation.
2. If the coverage of seedling trees and shrubs within the buffer area less than 25% after the third growing season these species will be replanted.
3. **If aerial coverage of wetland and upland plants is less than 50% after the fourth year, resource agencies will be consulted for advice on further measures to remedy the problems at the site. The monitoring program will be extended and such reasonable measures will be performed as are necessary to establish appropriate wetland vegetation. WSDOT will perform all reasonable measures considered necessary to establish and maintain a functioning wetland system.**
4. **The mitigation plan is designed to utilize and promote the growth of native vegetation. Attempts will be made to limit the spread of exotic species and not allow them to dominate the site. Noxious weeds, such as purple loosestrife, will be eliminated immediately if found occurring on the site before large populations can establish. A weed control program will be implemented if more than 10% of the wetland is invaded by invasive exotic species. It is expected that common reed grass will likely invade a portion of the created wetland. If it appears that this species is dominating the site, then resource agencies will be contacted to determine an appropriate course of action for control.**

**Operation and Maintenance**

A goal of the wetland mitigation site is to create a functional self sustaining system that should require very little maintenance. Once the vegetation establishes minimum disturbance will occur. The contractor will be responsible for plant survival of plant materials for a three-year period after initial planting acceptance. After this period, maintenance will be performed by WSDOT personnel and would be confined to repairing vandalism, erosion damage, minor revegetation (if necessary), and weed control.

**Monitoring**

The site will be monitored by WSDOT for a minimum of five years following mitigation construction and planting. The monitoring will be performed according to procedures outlined in WSDOT's Guide for Wetland Mitigation Project Monitoring (Horner and Raedeke, 1989). Monitoring reports will be issued annually to the Corps of Engineers, Department of Ecology, King County, and other resource agencies for review and comment. Successful mitigation will be measured by attainment of performance standards listed in the goals and objectives section of this document.

## Appendix H

### SR 167 Mill Creek 1A Success Standards

The following excerpt is from the *84<sup>th</sup> Ave S. to South Grady Way Stage 1A SR 167 Detailed Wetland Mitigation Plan* (WSDOT 1997). The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

#### Goals

The proposed mitigation plan includes the excavation of existing upland and replanting with native wetland tree and shrub species to provide approximately 0.48 hectare (1.2 acres) of wetland restoration. It also includes the enhancement of 2.33 hectares (5.75 acres) of existing wetlands to compensate for the loss of 1.57 hectare (3.95 acres) of wetland impacted by this project. The total amount of compensatory mitigation for this project is 2.81 ha (6.95 acres). On the proposed mitigation site, at total of 3.01 ha (7.44 ac) shall be planted with wetland vegetation. This area includes an additional 0.2 ha (0.5 ac) of enhanced wetland area as contingency mitigation. If the site should be completely successful, it is WSDOT's intention to apply the contingency mitigation acreage toward future wetland mitigation needs associated with the SR 167 corridor. The area of wetland mitigation considered successful shall be determined no earlier than the third year after planting. Successful acreage shall be considered to be those areas meeting the below stated standards of success.

In order to adequately compensate for the project's unavoidable impacts, this mitigation plan proposes to replace wetland types and functions which were most likely present on the site historically, not those functions which were impacted by this project. The reasoning for this is twofold. First, the primary functions provided by the majority of the impacted wetlands was water quality improvement and conveyance of highway runoff. This function will be replaced by the bioswales and wet ponds located in the impacted wetlands. Secondly, the proposed mitigation site already provides contaminant and nutrient removal/transformation functions but it could have its food chain support functions increased by providing more diverse and higher quality wildlife habitat.

#### Goals for this mitigation include:

- Restoration of 0.48 ha (1.2 acres) of wetland and enhancement of 2.33 ha (5.75 ac).
- Increase in the structural diversity of the existing wetland areas.
- Improve available wildlife habitat on the site, particularly for raptor prey species.
- Increase the vegetative species diversity of the existing wetland.
- Addition of topographic variations on the site.
- Establishment of a shrub buffer area along the western boundary of the site, which in time should become forested.

## **Objectives and Standards of Success**

### **Objective 1: Vegetation**

The mitigation site will include 2.19 hectares (5.14 acres) of scrub shrub wetlands which includes 0.83 hectares (2.06 acres) that should eventually become forested wetlands once the tree species reach at least 20 feet in height. The site will also include 0.82 hectare (2.03 acres) of emergent wetland communities.

#### **Standards of Success for Objective 1:**

##### **Third year**

- a. **There is  $\geq 15\%$  cumulative areal cover of trees and shrubs within the scrub-shrub wetland zones which includes at least 4 native species.**
- b. **The emergent wetland will have  $\geq 50\%$  areal cover which is composed of a minimum of three FACW or OBL species.**

##### **Fifth year**

- c. The mitigation areas have an overall vegetative cover of  $\geq 85\%$ , of which at least 65% of the herbaceous cover is composed of native species.
- d. There is  $\geq 35\%$  areal cover of trees and shrubs within the scrub-shrub wetland zones.
- e. Reed canary grass coverage will not exceed 30% areal coverage of the site.

### **Objective 2: Wildlife Habitat**

Wildlife habitat on the site will be increased through the addition of native species plantings, the reduction of reed canary grass and himalayan blackberry coverage, increased structural diversity and edge habitat, and the addition of habitat structures.

#### **Standards of Success for Objective 2:**

##### **Third year:**

- a. **There is  $\geq 15\%$  cumulative areal cover of trees and shrubs within the scrub-shrub wetland zones which includes at least 4 native species.**
- b. **Three types of habitat structures will have been installed on the site, constructed raptor perches, brush piles and large woody debris or boulders. The total number of habitat structures shall be at least 10 with two of those structures being raptor perches.**

##### **Fifth year**

- a. The mitigation site shall have a cumulative areal cover of  $\geq 85\%$  with at least 65% of the wetland species being native species.
- b. The site shall exhibit well developed structural diversity – defined as the distinction between herb, shrub and tree heights.



**Objective 3: Buffers**

The mitigation site shall have a vegetated buffer planted on the western edge of the site adjacent to the west Valley Highway. The buffer area shall range in width from 20 to 90 feet. It will be planted with native tree and shrub species to achieve a visual buffer within 10 years. The buffer should minimize disturbance to the site from the existing roadway and ongoing upslope development.

Standards of Success for Objective 3:

**Third year:**

- a. **There is  $\geq 15\%$  cumulative areal cover of trees and shrubs within the scrub-shrub wetland zones which includes at least 4 native species.**

Fifth year:

- a: The planted trees and shrubs shall have attained an areal cover of  $\geq 35\%$  within the buffer area and an overall vegetative cover of  $\geq 85\%$ .

## Appendix I

### SR 202 Dry Creek Success Standards

#### Success Standards

The following excerpt is from the Final Mitigation Plan *Vicinity SE 8<sup>th</sup> St. to Vicinity 300<sup>th</sup> Ave SE Settlement Correction/Channelization and Junction 244<sup>th</sup> Avenue NE Channelization, and NE Ames Lake Road Vicinity SR 202* (Ossinger and Tolon 1997). This mitigation plan applies to both the SR 202 Patterson Creek #2 mitigation site and the SR 202 Dry Creek re-channelization sites. The standards addressed this year are identified in **bold** font. Other standards will be addressed in the indicated monitoring year.

**Goals:** The goal of this compensatory mitigation project is to improve the overall wetland functioning of a degraded Patterson Creek wetland, especially with regard to wildlife habitat.

**Objective 1:** Alter the water regime in the emergent zone (to be preserved in the southwest portion of the enhancement area) to increase the duration of shallow ponding without endangering the survival of woody species.

#### Standard of Success:

All years :

- The existing emergent area shall be ponded to a depth of 40 cm in the spring and shall be shallowly ponded (at least in patches) in late summer.

**Objective 2:** Establish a variety of native trees and shrubs in the designated enhancement area.

#### Performance Standard:

After one year:

- Minimum of 80% survival of planted trees and shrubs, with no less than 25% survivorship within each individual species.

After three years:

- **Minimum of 60% survival of planted trees and shrubs, with no fewer than 75% of the total number of planted species remaining. (i.e., if 20 species are planted, at least 15 of those species will be present.)**

After five years:

- Evident plant community zonation in the enhancement area, with scrub-shrub, deciduous forested wetland, and mixed forested wetland zones represented. The forested wetlands to be dominated by tree species, although individuals may be less than 6 meters tall.
- There will be a minimum of 0.12 ha (0.30 ac) scrub-shrub wetland, 0.15 ha (0.37 ac) deciduous forested wetland, and 0.10 ha (0.25 ac) mixed forested wetland.

Objective 3: Reduce occurrence of reed canarygrass in the scrub-shrub and forested zones of the enhancement area.

Performance Standard:

**All years :**

- **The areal cover of reed canarygrass in the planted scrub-shrub and forested zones will not exceed 15%.**

## Appendix J

### SR 203 Harris and Morris Creek Success Standards

#### Success Standards

The following excerpt is from the *SR 203 Vicinity NE 77<sup>th</sup> Final Wetland Mitigation Plan* (Ossinger 1996) and the Hydraulic Project Approval 00-C5769-02, issued February 12, 1997. The same goals, objectives, and standards apply to the SR 203 Harris Creek and the SR 203 Morris Creek mitigation sites. The standards addressed this year are identified in **bold** font. Other standards will be addressed during the monitoring year specified in the standards of success.

#### Goals

The goal of this project is to restore natural plant communities and historic wetland types to two highly disturbed wetlands, thereby compensating for wetland functions lost due to project impacts. This will be achieved by enhancing existing wet pasture and farmland in the project area. Enhancement will increase ecological diversity by increasing the number of plant and animal species and communities that occupy these areas. Higher structural and species diversity will increase food-chain support function of the wetlands. As the plant communities mature, so will the soil mature as it is left undisturbed and allowed to accumulate organic matter and fine sediments. These changes cause an increased capacity for the wetlands to provide flood storage and stream base flow support. Increased base flow support and food chain support will benefit salmonid habitat in the adjacent streams.

#### Objective 1: Establish Native Vegetation

Establish a variety of native trees, shrubs, and herbaceous species.

##### Standard of Success:

Year 1:

- Minimum 80% survival of planted individuals, with no less than 25% survivorship of each individual species.

Year 3:

- **Minimum 60% survival of planted individuals, with no fewer than 75% of the total number of planted species remaining. (i.e if 20 species are planted, at least 15 of those species will be present onsite after 3 years.)**

Year 5:

- Evident zonation in the enhancement area, with emergent, scrub-shrub, and forested wetland (dominated by tree species, although individuals may be less than 6m tall) represented.

#### Objective 2: Reed Canarygrass Control

Reduce occurrence of reed canarygrass in mitigation area C (Morris Creek) and prevent its encroachment in to area A (Harris Creek).

Standard of Success:

**Years 1, 3, and 5:**

- **The aerial cover of reed canarygrass in both enhancement areas will not exceed 15%.**

**Contingency Plans**

Planted Vegetation

If stem counts reveal that standards of success for planted vegetation are not met, remedial action will take place after the cause of failure has been determined. Remedial action may include replanting with more of the original species and/or replanting with different native species.

Reed Canarygrass

If the cover of reed canarygrass exceeds that specified in the standards of success, control measures will be implemented involving the most effective means available, which may include physical, chemical or mechanical control.

**Additional Permit Requirements**

The Hydraulic Project Approval 00-C5769-02, issued February 12, 1997 includes the following points:

- 21. Nondesirable and/or invasive vegetation shall be removed. The method of removal shall be by hand or mechanical means unless herbicides are specifically approved.
- **23. Monitoring, maintenance and replacement of the vegetation shall be conducted as necessary to assure 80 percent survival after 3 years.**
- **24. An analysis of how the mitigation site is functioning compared to the preproject goals shall be conducted after 3 years. If the goals are not being met, additional mitigation shall be conducted as necessary to achieve those goals. The additional mitigation shall be conducted within 1 year of the third year analysis.**

## Appendix K

### SR 203 Stillwater Hill Road Success Standards

The following excerpt is from the *SR 203 Vicinity NE 77 Supplement #3 to Final Wetland Mitigation Plan* (WSDOT 2001). The criteria addressed this year are identified in **bold** font. Other tasks will be addressed in the indicated monitoring year.

#### Mitigation Goals

The goals of the buffer enhancement are to improve ecological diversity by increasing the number of plants and plant species, and to ameliorate slope stabilization and water filtration with woody vegetation. As the more diverse plant communities mature so will the ecological diversity.

#### Standards of Success/Contingency Plan

##### Objective

Establish a variety of native, shrubs, and trees within the existing buffer areas. See “Buffer Enhancement Plan” plan sheets for locations.

##### Standards of Success

##### Monitoring Year 1, 2 and 3:

**Minimum 80% survival of planted species.**

##### Contingency

**In the first year of plant establishment, all dead or unhealthy plants will be replaced.** In the second and third year of plant establishment, if over 20% of the plants are mortal then replanting of the mortal species will occur.

##### Monitoring of Buffer Enhancement Areas

**The buffer enhancement areas will be monitored on years 1, 2 and 3 following the planting. Monitoring will include a count of plants to determine if plant survival percentages have been met.**

## Glossary of Terms

**Abundance (total)** – the total number of individuals, cover, frequency of occurrence, volume, or biomass of a species, or group of species, within a given area.

**Accuracy** – the closeness of a measured or computed value to its true value.

**Adaptive management** – the process of linking ecological management within a learning framework (Elzinga et al. 1998).

**Aerial cover** – is the amount of ground covered by vegetation of a particular species or suite of species when viewed from above. Aerial cover is expressed as a percentage. Values for aerial cover are typically obtained from point-line, point-frame, or line intercept data.

**Areal estimates** – are made using the known boundary of a feature or statistical population. Areal estimates are often expressed in units of area.

**Aquatic vegetation** – includes submerged and rooted (*Elodea*, *Myriophyllum*) or floating (non-rooted) plants (*Lemna*, *Azolla*, *Wolffia*). For compliance purposes, these plants are not included in cover estimates. Vascular, rooted, floating-leaved plants *are* included in cover estimates (e.g., *Nuphar*, *Potamogeton*).

**Bare ground** – an area that can support, but does not presently support vascular vegetation.

**Canopy cover** – the coverage of foliage canopy (herbaceous or woody species) per unit ground area.

**Community** – a group of populations of species living together in a given place and time.

**Confidence interval (CI)** – is an estimate of precision around a sample mean. A confidence interval includes confidence level and confidence interval half-width.

**Cryptogam** – any of the *Cryptogamia*, an old primary division of plants comprising those without true flowers and seeds including ferns, mosses, and thallophytes (algae, fungi, and lichen).

**Density** – the number of plants per unit area (typically square meters).

**Densitometer** – a hollow T-shaped polyvinyl chloride (PVC) device that includes horizontal and vertical leveling and a mirror to locate a precise vertical point in space either directly above or directly below the densitometer. Target vegetation intersecting the vertical line of sight through the instrument is recorded.

**Herbaceous** – with characteristics of an herb; an annual, biennial, or perennial plant that is leaflike in color or texture, and not woody.

**Hydric soils** – soils formed under the conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (Federal Register 1994).

**Invasive** – A plant that interferes with management objectives on a specific site at a specific point in time (Whitson et al. 2001). For monitoring purposes, invasive species include those listed on the current County Noxious Weed List, and on a site-by-site basis, other species may be included (such as *Rubus armeniacus* (Himalayan blackberry)).

**Line-segment** – a linear sample unit that is used to measure vegetative cover.

**Macroplot** – usually refers to a relatively large sampling area in which sub-sampling will be conducted, often using quadrats, line-segments or point-lines (Elzinga et al. 1998).

**Open water** – an area intended to be non-vegetated and permanently inundated as described in the site mitigation or planting plan.

**Point frame** – is a square or rectangular quadrat that consists of a set of identified points used to collect vegetation data.

**Point Intercept Device** – a tripod that supports a rod that can be leveled and lowered vertically to intercept target vegetation at an identified point.

**Point-line** – linear series of points comprising a sample unit.

**Point quadrat (points)** – a single point, used to sample vegetation data. The point quadrat is theoretically dimensionless.

**Population (biological)** – all individuals of one or more species within a specific area at a particular time.

**Population (statistical)** – the complete set of individual objects (sampling units) about which inferences are made.

**Precision** – the closeness of repeated measurements of the same value.

**Quadrat** – an area delimited for sampling flora or fauna; the sampling frame itself.

**Random sampling** – sampling units drawn randomly from the population of interest.

**Relative abundance (birds)** – the number of individuals per unit of sampling effort.

**Relative Cover** – The proportion of specific target vegetative cover compared to that of all the vegetative species in the community combined (Brower et al. 1998).

**Restricted Random Sampling Method** – a sampling method that divides the population of interest into equal-sized segments. In each segment, a single sampling unit is randomly



positioned. Sampling units are then analyzed as if they were part of a simple random sample (Elzinga et al. 1998).

**Sample** – a subset of the total possible number of sampling units in a statistical population.

**Sample size equations** – use sample mean and standard deviation to determine if data have been collected from enough sample units to meet the sampling objectives.

**Sample standard deviation** – a value indicating how similar each individual observation is to the sample mean.

**Sampling** – the act or process of selecting a part of something with the intent of showing the quality, style, or nature of the whole.

**Sampling objective** – a clearly articulated goal for the measurement of an ecological condition or change value (Elzinga et al. 1998). Sampling objectives provide a complement to success standards and describe the desired level of precision for sampling. Elements of a sampling objective include the desired confidence level and confidence interval half-width, or the acceptable false-change error and acceptable missed-change error level.

**Sampling units** – the individual objects that collectively make up a statistical population.

**Standard deviation** – a measure of how similar each individual observation is to the overall mean value.

**Shrub** – a woody plant which at maturity is usually less than 6m (20 feet) tall and generally exhibits several erect, spreading, or prostrate stems and has a bushy appearance (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

**Species richness** – the total number of species observed on a site.

**Structures** – any structure that is not expected to support vegetation during the monitoring period. Structures may include habitat structures, rocks, and other artifacts.

**Stratified Random Sampling Method** – The population of interest is divided into two or more groups (strata) prior to sampling. Within each stratum the sample units are the same. Sample units from different strata may or may not be identical. Random samples are obtained within each group (Elzinga et al. 1998).

**Systematic Random Sampling Method** – the regular placement of quadrats, points, or lines along a sampling transect following a random start.

**Transect** – For vegetation surveys, the transect is a line used to assist in the location sample units (point-lines, quadrats, line segments or frames) across the monitoring study area.

**Tree** – a woody plant that at maturity is usually 6m (20 feet) or more in height and generally has a single trunk, unbranched for 1m or more above ground, and more or less definite crown (Cowardin et al. 1979). The species categories in this report follow Cooke (1997).

**Vegetation structure** – the physical or structural description of the plant community (e.g. the relative biomass in canopy layers), generally independent of particular species composition.

**Wetland-dependent species (birds)** – restricted in temporal or spatial distribution to wetlands based on an intrinsic feature or features of the environment (Finch 1989).

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